The position of DOE in its Draft Request for Proposals for transportation proposes the use of special trains and advanced rail technology for shipping spent nuclear fuel and high-level radioactive waste, as long as the operator can demonstrate this option is cost-effective and lessens the potential for adverse railroad incidents.

8.10 Transportation Accidents

8.10 (54)
Comment - 7 comments summarized
Several commenters expressed concern about the validity of the accident data and statistics used in the EIS analyses and questioned why state-specific data were not used. Another commenter suggested that local transportation agencies should have been contacted rather than just the State Departments of Transportation. One commenter asked about the number of accidents per year. A commenter from Georgia demonstrated that the Draft EIS provided very little state-specific data, which the commenter stated should have been included. Another commenter suggested that accident rates for hazardous material shipments should be used rather than overall accident rates and that costs of accidents should be provided.

Response
In estimating transportation impacts, the EIS used state-specific highway and railroad accident rates for 1994 through 1996. These data were obtained from the U.S. Department of Transportation Motor Carrier Safety Information System and the Federal Railroad Administration, respectively. To supplement these data, DOE requested that the 48 contiguous states provide truck and rail transportation accident data for use in the EIS. Five states responded with highway data – Nevada, California, Illinois, Nebraska, and South Carolina. No state submitted railroad data. DOE compared the data provided by the five states to the data from the Motor Carrier Safety Information System and found that the differences were small. A detailed discussion of this evaluation is provided in Section J.1.4.2.3 of the EIS. DOE did not use local data because the Motor Carrier Safety Information System and the Federal Railroad Administration data are aggregations of local data and, therefore, include these data.

DOE did not use data for hazardous materials incidents to estimate transportation impacts because many times the criteria used for reporting incidents are not relevant to incidents that could damage a spent nuclear fuel cask. For example, gasoline tanker truck spills, which are reported as incident, are not accidents that are comparable to those that might damage a spent nuclear fuel cask. In any case, the Motor Carrier Safety Information System would include these types of incidents in the accident rate if they resulted in a fatality or injury, or if the damage to the gasoline tanker truck was severe enough to result in the gasoline tanker truck being towed away.

Special requirements imposed on the transportation of spent nuclear fuel and high-level radioactive waste, as discussed in Section M.2 of the EIS, would be expected to reduce the accident rates for shipments to Yucca Mountain to below those assumed in the EIS and those experienced by routine hazardous waste shipment.
In response to public comments, DOE has added maps of the routes analyzed in the EIS, the state-by-state number of shipments and impacts, and a discussion on the range of potential costs of cleanup following a severe transportation accident to the EIS (see Section J.4).

8.10 (68)
Comment - 14 comments summarized
Commenters stated that the EIS does not provide a description of the maximum reasonably foreseeable accident. A commenter stated that a description of other accidents and incidents that are less than the maximum reasonably foreseeable accident should be provided to determine the impact of these on emergency response systems. A commenter requested DOE to analyze specific accident scenarios in Nevada. Another commenter indicated that the EIS generalizes that the likelihood of an accident in Nevada would be less than that for the rest of the Nation. Nevada commenters stated that the EIS must consider a spent nuclear fuel and high-level radioactive waste truck colliding head-on with another truck loaded with commercial or military explosives, with a truck or rail cask involved in a massive infrastructure failure (for example, bridge collapse) and a natural disaster (for example, a flood), and a rail or truck cask involved in an accident with a military aircraft. Another commenter stated that DOE has, in its accident analysis, given credence to the virtually impossible scenario and also stated that the chances that

such a worst case accident could occur essentially is zero. Another commenter stated that the Draft EIS "tweaks" the accident figures to understate the transportation risks to the actual people who will be affected.

Response

In response to public comments, DOE has substantially revised and expanded the transportation accident analyses in the EIS. Since DOE issued the Draft EIS, Sandia National Laboratories completed a study for the Nuclear Regulatory Commission, *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). The purpose of the study was to reexamine the risks associated with the transportation of spent nuclear fuel by truck and rail and compare the results to those published in NUREG-0170 (DIRS 101892-NRC 1977) and *Shipping Container Response to Severe Highway and Railway Accident Conditions* (DIRS 101828-Fischer et al. 1987; also called the Modal Study). The Draft EIS used the techniques, assumptions and data from the Modal Study. The new study concluded that earlier studies made a number of very conservative assumptions about spent nuclear fuel and cask responses to accident conditions, which caused their estimate of accident source terms, accident frequencies, and accident consequences to be very conservative (tended to overstate the risk) (Sprung et al. 2000).

DOE has revised Section J.1.4.2 of the EIS to include a description of the maximum reasonably foreseeable accident. As in *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000), accidents are not described in terms of specific circumstances, because various accidents could lead to the same combination of cask failure mechanism, impact velocity range, and temperature range. However, detailed "event trees" are presented for truck and rail accidents, as in Figures 7.3 and 7.4 of Sprung et al. (2000). These event trees illustrate the different combinations of events that occur during an accident. This approach to accident analysis precludes the necessity for analyzing numerous specific cases involving various collisions (such as airplanes and military trucks with explosives), various natural disasters, specific locations (such as mountain passes), or various infrastructure accidents. They are all covered by the considerations of impact velocities and temperatures on a cask. Some of these accidents would result in impact velocities and temperatures that exceed the Nuclear Regulatory Commission cask performance standards in 10 CFR Part 71.

The conditions of the maximum reasonably foreseeable accident analyzed in the EIS envelop conditions reported for the Baltimore Tunnel fire (a train derailment and fire that occurred in July 2001 in a tunnel in Baltimore, Maryland). Temperatures in that fire were reported to be as high as 820ºC (1,500ºF), and the fire was reported to have burned for up to 5 days.

The text box in Section 6.3.1.3.2 of the EIS discusses the likelihood of the maximum reasonably foreseeable accident occurring in Nevada. This is an extremely unlikely accident with a likelihood of occurrence of less than 2.8 in 10 million per year for the national transportation routes. The likelihood of this accident is directly related to the total number of shipment miles during the estimated 24-year duration of the shipment campaign. Total shipment miles outside Nevada greatly exceed the total shipment miles inside the State. Therefore, the EIS is correct in stating that it is more likely that this type of accident would occur outside Nevada than inside the State, and it is unlikely that a location in Nevada "will be the most likely setting in the nation for a worst-case accident."

The shipping casks used to transport spent nuclear fuel and high-level radioactive waste would be massive and tough with design features that complied with strict regulatory requirements that would ensure the casks performed their safety functions even when damaged. Numerous tests and extensive analyses have demonstrated that casks would provide containment and shielding even under severe accidents conditions. Based on the revised analyses in Sprung et al. (DIRS 152476-2000)., DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the more than 2,700 shipments of spent nuclear fuel over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

DOE could decide to use a dedicated train that carried only the material to be shipped to Yucca Mountain, or could elect to move the spent nuclear fuel and high-level radioactive waste in general freight. If the material was shipped as general freight, the position of the spent nuclear fuel or high-level radioactive waste car in the train would be

regulated by 49 CFR 174.85. This regulation requires that railcars placarded "radioactive" must be separated from a locomotive, occupied caboose, or carload of undeveloped film by at least one nonplacarded car, and it cannot be placed next to other placarded railcars of other hazard classes.

8.10 (145)
Comment - 13 comments summarized
Commenters expressed concern about the impacts of contamination of surface water or groundwater from a transportation accident. Commenters expressed concern with impacts to surface-water bodies such as local rivers (for example, the Muddy and the Humboldt), major rivers (for example, the Mississippi and the Colorado), Lake Mead, and wellhead areas of public water supplies as well as groundwater systems. Other commenters expressed concern about comprehensive emergency planning and response capabilities, and their funding, and potential mitigation measures and who would implement them. Other commenters expressed concern about effects on food and natural resources affected by releases to surface- and groundwater bodies.

Response
The shipping casks used to transport spent nuclear fuel and high-level radioactive waste would be massive and tough with design features that complied with strict regulatory requirements that would ensure the casks performed their safety functions even when damaged. The casks would be designed to be watertight even after a severe accident. Furthermore, the high-level radioactive waste would be in a solid form that would not be easily dispersed (ceramics, metals, or glasses).

Numerous tests and extensive analyses, using the most advanced analytical methods available, have demonstrated that casks would provide containment and shielding even under the most severe kinds of accidents. Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

The EIS does not specifically analyze a transportation accident involving contamination of surface water or groundwater. Analyses performed in previous EISs (see Section 1.5.3 and Table 1-1 of this EIS) have consistently shown that the airborne pathway has the greatest potential for exposing large numbers of people in the event of a release of radioactive materials during a severe transportation accident. An analysis of the potential importance of water pathway contamination for spent nuclear fuel transportation accident risk using a worst-case water contamination scenario (DIRS 157052-Ostmeyer 1986) showed that the impacts of the water contamination scenario were about one-fiftieth of the impacts of a comparable accident in an urban area. Thus, it is extremely unlikely that an accident that resulted in a cask falling into any body of water would result in surface-water contamination, let alone groundwater contamination.

As discussed in Section J.1.1.4, the EIS does not specifically analyze a transportation accident involving contamination of surface-water or groundwater. While small particles generated by the impact forces and driven out of the cask by a severe fire (which would be extremely unlikely because there would be no fuel to sustain an engulfing fire of the type required to release radioactive material) could ultimately end up contaminating soils and surface waters outside the cask, this would not be the dominant pathway for radiological exposure and uptake after an accident.

A state is the primary authority responsible for the health and safety of its population and therefore, generally has the primary responsibility in responding to accidents that occur in its jurisdiction. However, a state can request assistance from Federal agencies as it judges what would be appropriate and needed to effectively respond to an accident. DOE, along with other Federal agencies, has the ability to respond quickly to radiological emergencies in any state, if requested. In addition, under U.S. Department of Transportation regulations, shippers and transporters have responsibilities for emergency response and cleanup. More information on emergency response is provided in

Appendix M of the EIS. In addition, Section M.8 discusses the broad indemnification for liability of all personal injury and property damage, including costs of emergency response, evacuation, and postaccident recovery and remediation activities, under provisions of the Price-Anderson Act and state law.

8.10 (148)
Comment - 17 comments summarized
Commenters stated that emergency management impacts are a critical component of the EIS and stated that the Draft EIS was inadequate because the economic impacts of cleaning up a radioactive release that could result in roads and businesses being shut down was not estimated. Other commenters stated that cleanup activities could cost hundreds of millions or billions of dollars. Others stated that no clear description of the maximum reasonably foreseeable accident was provided; nor were the costs to mitigate or to recover from that accident evaluated. Commenters stated that the 1986 Environmental Assessment for the Yucca Mountain site (DIRS 100136-DOE 1986) developed a worst-case accident scenario that resulted in the contamination of a 110-square-kilometer (42-square-mile) area, would require 462 days and cost $620 million to clean up in 1985 dollars, and stated that the Draft EIS should have provided the same information. Other commenters stated that if the RADTRAN code was run with updated dollar inflators to 2000, the costs could range from $2.5 billion to $9.4 billion. Commenters asked if such an accident was to occur, how large an area could be affected and stated that in an urban area such as Las Vegas, the impacts would be incredible. Commenters stated there are no known statistics as to the amount of damage that would occur in the area of the accident and questioned what it would mean for a community to experience such an accident and asked how long would people have to be evacuated, would it ever be safe for people to return, and what would the resulting health impacts be?

Response
In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments, and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $9.4 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive contamination. The studies address consequences for releases of radioactive materials in communities.

Although the studies project high costs for cleanup following severe accidents, the accidents evaluated would be very unlikely and, as a consequence, DOE believes the economic risks of transportation accidents would be very small. The shipping casks used to transport spent nuclear fuel and high-level radioactive waste would be massive and tough with design features that complied with strict regulatory requirements that would ensure the casks performed their safety functions even when damaged. Furthermore, the high-level radioactive waste would be in a solid form that would not be easily dispersed (ceramics, metals, or glasses).

Numerous tests and extensive analyses, using the most advanced analytical methods available, have demonstrated that casks would provide containment and shielding even under the most severe kinds of accidents. Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

DOE anticipates that the economic costs of accidents where there was no release of radioactive material would not be substantial. The health and safety consequences of a maximum reasonably foreseeable transportation accident are discussed in Section 6.2.4.2 of the EIS. The EIS analysis did not include the restorative effects of postaccident recovery, remediation, or cleanup in estimating the health and safety impacts, and would, therefore, tend to overestimate, rather than underestimate, actual radiological impacts.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site was approved. See the introduction to Chapter 8 of this Comment-Response Document for more information.

8.10 (154)
Comment - 10 comments summarized
Commenters expressed concern about military aircraft crashes into spent nuclear fuel and high-level waste storage facilities and shipping casks during transportation. In addition, commenters expressed concern about accidents involving live military ordnance (for example, heat seeking missiles) or practice weapons on storage facilities and shipping casks during transportation. Commenters indicated that most transportation routes, rail and truck, cross or approach Nellis Air Force Base or Range, Fallon Naval Air Station, or other air training and practice ranges and, therefore, mitigative measures must be considered. Commenter concerns were for an understanding of potential impacts on cargo and on people, and impacts on military operations.

Response
An aircraft crash into a spent nuclear fuel or high-level radioactive waste cask would be extremely unlikely because the probability of a crash into such a relatively small object, whether stationary or moving, is extremely remote. Nonetheless, Section J.3.3.1 of the EIS analyzes consequences of an accident in which a large commercial aircraft or of a military aircraft is hypothesized to impact directly onto a cask. The analysis showed that the heavy shield wall of a cask could not be breached by the center shaft's penetrating force. With the exception of engines, the relatively light structures of an aircraft would be much less capable of causing damage to a cask. A resulting fire would not be sustainable or able to engulf a cask long enough to breach the integrity of the cask.

System malfunctions or material failures that could result in either an accidental release of ordnance or release of a practice weapon were discussed in the *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (DIRS 103472-USAF 1999), and the *Final Environmental Impact Statement, Withdrawal of Public Lands for Range Safety and Training Purposes, Naval Air Station Fallon, Nevada* (DIRS 148199-USN 1998). The *Special Nevada Report* (DIRS 153277-SAIC 1991) states that the probability of dropped ordnance resulting in injury, death, or property damage ranges from about 1 in 1 billion to 1 in 1 trillion per dropped ordnance incident, with an average of about 1 in 10 billion per dropped ordnance incident. Less than one accidentally dropped ordnance incident is estimated per year for all flight operations over the Nellis Air Force Range (now called the Nevada Test and Training Range) and Naval Air Station Fallon. All of these analyses are incorporated in this EIS by reference. Spent nuclear fuel transportation would not affect the risk from dropped ordnance or aircraft crashes. The EIS does not evaluate radiological consequences of an impact of accidentally dropped ordnance on a shipping cask because the probability of such an event (about 1 in 10 billion per year) is so extremely low that it is not reasonably foreseeable. Accordingly, the Department believes there would be no need for associated mitigation measures and no impacts on military operations.

8.10 (155)
Comment - 14 comments summarized
Commenters stated that the Draft EIS is deficient in that it does not adequately address factors that could lead to human error and effects of organizational behavior (such as not following regulations or guidelines) on the spent nuclear fuel and high-level radioactive waste transportation system. That is, it is not adequate to state, as the Draft EIS does, that utilizing trained, qualified, and aware personnel would reduce accident risk. Several recent catastrophic accidents were offered as evidence of the human error factor (for example, Three Mile Island, Chernobyl, Bhopal, and *Challenger*). Commenters stated that a detailed description of the transportation system would be necessary for an analysis of the effect of human error on transportation risk and that such a description was not in the Draft EIS. Commenters stated that the focus of human error analyses should be on the interaction between human beings and the system of equipment, facilities, procedures, and environments. Clark County commenters described, in some detail, the various categories of human and organizational behavior that must be addressed along with examples from the DOE low-level radioactive waste transportation system. Specific issues identified included individual management behavior, institutional arrangements, organizational errors and factors, operator behavior, perceptual judgement, risk taking, accident rates and mitigation, design specifications, quality assurance, equipment manufacturing, system descriptions, inexperienced drivers, and rail and highway infrastructure.

Commenters wanted answers to several questions, including: what is the contribution of human factors (for example, errors) to truck and rail accident rates? How can this contribution be mitigated? Is the effect of human factors reflected in the accident rates used in the Draft EIS? Does the DOE transportation system have a positive or negative effect on these factors? Does the design of the rail and highway infrastructure exacerbate or mitigate these effects? How do human factors play in the privatization of the DOE spent nuclear fuel and high-level radioactive waste transportation system?

Response
Section J.1.4.2.1 of the EIS discusses potential effects of human error on accident probabilities and impacts. In addition, that section discusses how effects of human factors and errors are included in the risk. For example, the truck and rail accident rates used in the EIS include accidents involving all causes, including human error. Thus, human error is factored into accident rates and ultimately transportation risk. The accident rates used in the analysis are based on national transportation statistics, although use of highly trained and qualified personnel in transporting spent nuclear fuel and high-level radioactive waste, and preferred routes for highway shipments, would tend to mitigate the number and severity of transportation accidents. Use of preferred routes for highway shipments and expeditious routing for rail shipments (see Section J.1.2.2) would result in use of a transportation infrastructure that minimized radiological risk and time in transit. The analysis of transportation impacts did not take credit for these factors. In addition, the effects of emphasizing training and qualification of personnel who would be employed by DOE and contractors to transport spent nuclear fuel and high-level radioactive waste were not given credit in the assessment. Therefore, DOE believes that the accident rates used for analyses might tend to overstate the risk.

As discussed in Section 6.2 of the EIS, national transportation of spent nuclear fuel and high-level radioactive waste would use existing highways, railroads, and waterways. Section 6.3 describes transportation in Nevada that would use a combination of legal-weight trucks and heavy-haul trucks or railroads. Section 2.1.3 present conceptual descriptions of the vehicles that would transport the casks.

In response to public comments, DOE added Appendix M to the EIS to present information intended to assist readers in understanding transportation of spent nuclear fuel and high-level radioactive waste. Section M.3 presents DOE Transportation Practices, which were developed with input from states and other stakeholders. These practices, which would be applicable to contractors who would transport spent nuclear fuel and high-level radioactive waste, address concerns regarding compliance with transportation regulations and measures to reduce the frequency and severity of transportation accidents.

The Nuclear Regulatory Commission is considering including an assessment of the importance of human factors in cask design, manufacturing, and use in its planned Package Performance Study. The planned study, which is scheduled for completion in 2004, will provide an updated evaluation of the level of safety provided by spent nuclear fuel transport packages under a variety of railway and highway accident conditions.

8.10 (156)
Comment - 14 comments summarized
Commenters expressed concern about the use of the Nuclear Regulatory Commission's *Shipping Container Response to Severe Highway and Railway Accident Conditions* (Fischer et al. 1987; also called the Modal Study) in the EIS transportation accident analyses. Commenters stated that the assumptions, data, and models of the study are outdated and that the entire discussion of the Modal Study must be revised to address both the technical and procedural implications of the reassessment of the study currently being conducted by the Nuclear Regulatory Commission. Of particular concern was the design of current casks and the statistics concerning accidents and transportation system conditions. Other commenters expressed concern that only one model and one set of data were used, which did not allow comparison of results from alternative models or data sets. One commenter stated that changing the "reasonably foreseeable" criterion of 1 in 10 million, including proper accident distribution data, including real cask response to accident conditions, and using proper estimations of accident probabilities would make some circumstances in the Modal Study "reasonably foreseeable"; therefore, they must be considered in any acceptable consequence analysis.

Response
In March 2000, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). The purpose of the study was to reexamine the risks associated with

the transport of spent nuclear fuel by truck and rail and compare the results to those published in *Final Environmental Impact Statement on the Transportation of Radioactive Material by Air and Other Modes* (DIRS 101892-NRC 1977) and *Shipping Container Response to Severe Highway and Railway Accident Conditions* (DIRS 101828-Fischer et al. 1987). The new study concluded that both NRC (1977) and Fischer et al. (1987) made a number of very conservative assumptions about spent nuclear fuel and cask response to accident conditions, which caused their estimate of accident source terms, accident frequencies, and accident consequences to be very conservative (tending to overstate the risk). The new study also concluded:

"Based on this more detailed analysis, cask leakage is found to be even less likely than the estimates of the Modal Study, and retention of particles and condensable vapors by deposition onto cask interior surfaces is found to be substantial. Accordingly, both source term probabilities and magnitudes decrease further, and consequently accident population dose risks are reduced further by factors of 10 to 100" (DIRS 152476-Sprung et al. 2000).

DOE has updated the EIS transportation impact analysis to incorporate relevant findings of the updated Nuclear Regulatory Commission analysis. Sections 6.2.4 and J.1.4 of the EIS, concerning analysis of transportation accidents, have been revised to incorporate data from Spring et al. (DIRS 152476-2000). The EIS no longer relies on the data from the Modal Study. [However, data from the Modal Study are used in Spring et al. (2000).] This report contains revised estimates of probable releases from spent nuclear fuel casks during severe transportation accidents that involve long-duration fires accompanied by high impact forces. The effect of incorporating the new analyses was lower estimates for radiological risk than those presented in the Draft EIS.

The Nuclear Regulatory Commission is conducting the Package Performance Study to assess the performance of spent nuclear fuel packages during transportation accidents and to verify assumptions used in Sprung et al. (DIRS 152476-2000). The planned study, which is scheduled for completion in 2004, will provide an updated evaluation of the level of safety provided by spent nuclear fuel transport packages under a variety of railway and highway accident conditions.

8.10 (157)
Comment - 18 comments summarized
Commenters expressed concern about cancer and other detrimental health effects as a result of a transportation accident and about direct exposure to spent nuclear fuel or high-level radioactive waste due to an accident. Various potential short-term and long-term health effects were described to accentuate the concerns.

Response
The shipping casks used to transport spent nuclear fuel and high-level radioactive waste would be massive and tough with design features that complied with strict regulatory requirements that would ensure the casks performed their safety functions even when damaged. Numerous tests and extensive analyses have demonstrated that casks would provide containment and shielding even under the most severe kinds of accidents. Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

The study concluded that in severe accidents cask leakage would be even less likely than previous estimates, such as *Shipping Container Response to Severe Highway and Railway Accident Conditions* (DIRS 101828-Fischer et al. 1987), and retention of particles and condensable vapors by deposition onto the cask interior surfaces would be substantial. The study concluded that: "Accordingly, both source term probabilities and magnitudes decrease further, and consequently accident population dose risks are reduced further by factors of 10 to 100" (DIRS 152476-Sprung et al. 2000).

In response to public comments, DOE has updated the transportation accident impact analyses in the EIS to incorporate the findings of the updated analysis. Sections 6.2.4.2 and J.1.4 of the EIS analyze the potential health impacts of transportation accidents. The EIS evaluates the maximum consequences of such an accident if it occurred. For example, Table 6-14 provides the estimated impacts of the maximum reasonably foreseeable accident for truck transportation. The highest consequences would occur in an urbanized area with a potential for (0.55) latent cancer fatalities. The likelihood of such an accident would be very small, about 2.3 in 10 million years. Table 6-15 presents the same data for the mostly rail scenario. The maximum reasonably foreseeable accident for rail transportation would occur in an urbanized area with a potential for 5 latent cancer fatalities. Similar to the truck accident, the likelihood of such a rail accident would be very small, about 2.8 in 10 million years.

8.10 (168)
Comment - 8 comments summarized
Commenters complained that the analyses in the EIS averaged the impacts of transporting spent nuclear fuel and high-level radioactive waste across the entire Nation for 30 years, and then concluded that these impacts would be insignificant. This was viewed as misleading because it diminishes the significance of impacts in specific cities or areas. One commenter does not believe it is acceptable to average the risks over 50 million people.

Response
The impacts reported in the EIS are the estimated impacts summed over the specific routes used for analysis in the EIS over the period necessary to ship the spent nuclear fuel and high-level radioactive waste, not the average impact across the Nation. The transportation impacts in the EIS were evaluated over the entire shipping period. The total impacts to exposed populations over that period were calculated. The techniques used best reflect the actual potential for radiological exposure from the proposed activities associated with each of the alternatives. In response to comments, Appendix J of the EIS has been expanded to include additional information on the state-specific accident data, route maps, and impact data (see Section J.4).

The transportation impacts in the EIS were not averaged over the entire population of the United States, hence the calculated exposed population would not be 50 million, as asserted. Rather, the transportation impacts were integrated over the exposed population along the transportation routes analyzed in the EIS and extrapolated to 2035. As discussed in Sections 6.2.3.1 and 6.2.3.2 of the EIS, the estimated exposed population ranged from 10 million for truck shipments to 16 million for rail shipments. For perspective, the population of the United States was about 250 million in 1990 and 280 million in 2000.

8.10 (299)
Comment - EIS002232 / 0002
The transport of high-level nuclear energy through Inyo and San Bernardino and neighboring California counties creates an unacceptable risk of accidental discharge.

Response
As discussed in Appendix J.1.4 of the EIS, the release of radioactive materials during an accident would be an extremely unlikely event (the estimated probability of even a small release would be 0.01 percent). Transportation safety related to potential release of radioactive materials is primarily based on the integrity of the shipping cask. The leaking of a transportation cask could only occur if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. Additional information on the safety and testing of transportation casks is provided in Section M.4. The accidents analyzed in the EIS is believed to cover accidents from all sources including heat, mechanical impacts, sabotage, impacts from airplanes and weapons, and mountain rollovers.

Section J of the EIS contains maps of each state in which transportation shipments would originate or through which they would pass. The maps have tables that list the number of shipments involved in the state and the impacts from these shipments within the state. The radiological health and safety impacts of transporting spent nuclear fuel and high-level radioactive waste in California are listed in Table J-74. The risks in Inyo County and San Bernardino would be lower than those presented in Table J-74 for the whole State.

8.10 (632)
Comment - EIS000159 / 0005
The transport accident analysis is unclear. It is impossible to assess the draft EIS basis for impacts of transportation accidents based on the vague descriptions in the reports and appendices.

Response
EIS Section 2.4.4 provides a summary discussion of the impacts of transportation accidents. More detailed discussion is provided in Chapter 6, and an in-depth description of the methodology, models, and sources of data used in the analysis is provided in Appendix J. A new Appendix M has been added to the EIS that contains additional information on topics such as transportation regulations, cask safety and testing, emergency response, and physical protection of spent nuclear fuel casks.

8.10 (738)
Comment - EIS000195 / 0002
In the second title Occupational and Public Health and Safety, page 6-95, you discuss traffic fatalities along the heavy haul routes.

What about traffic related injuries? That should also be addressed.

Response
The transportation analyses for Nevada provided in Section 6.3 of the EIS, presents the radiological and nonradiological impacts important to comparing the impacts of the Proposed Action and the No-Action Alternative. Traffic fatalities were used as the measure of impact because they can be combined with radiation-related latent cancer fatalities to yield an estimate of the total number of fatalities for the Proposed Action and the No-Action Alternative. In contrast, combining traffic related injuries with radiation-related latent cancer fatalities or radiation detriment would not yield an easily understandable estimate of total impacts.

8.10 (773)
Comment - EIS000096 / 0003
The Draft EIS largely ignores adverse environmental impacts of rail construction and operation on Tonopah, Goldfield, and Beatty. Under certain circumstances, these three communities would be close enough to the repository rail line to require evacuation in the event of a severe accident or terrorist attack. A rail accident or incident releasing radioactive materials would threaten public health and safety and harm the local economy.

Response
The analysis of human health and safety and environmental impacts for the rail transportation implementing alternatives affecting Tonopah, Goldfield, and Beatty can be found in Section 6.3.2 of the EIS. While a specific analysis of a severe accident or terrorist attack in the vicinity of these communities was not conducted, maximum reasonably foreseeable accidents were analyzed for national transportation. These results are reported in Section 6.2.4.2. The EIS analysis assumed that an accident determined to be reasonably foreseeable for national transportation could occur in Nevada with similar results.

8.10 (817)
Comment - EIS000144 / 0002
The Day Everything Went Wrong

It is a February day on Highway 93. Temperatures are hovering at roughly -50 degrees, considering the wind chill factor. A blizzard howls as the legal limit truck, carrying plutonium, negotiates the road. Visibility is severely limited. The driver is tired and knows he can't stop in Ely, for the government, as a sop to the people, has made it illegal for such shipments to halt within the populous areas of White Pine County. The truck has almost skidded off the ice-encrusted road on several occasions. The driver is tense.

Suddenly, a herd of mustangs appears out of the white-out; one, a white stallion, bewildered, races directly toward the truck. The driver can't swerve, he can't gear down--there's no time. The truck plows into the pale horse; the horse is thrown onto the truck's hood. Screaming. Its hooves and carcass smash through the windshield. The driver loses control; the truck hits a skid. The hardened trailer topples onto its side, propelling it and the cab off the road.

His seat belt has held the driver securely. He is shaken, glass covered, with several shallow cuts, but otherwise unhurt. After a moment, in which he composes himself, he swears at the horse bleeding furiously into the cab. He gets cautiously out, being careful not to tip the cab over. It feels like it might go; it's already up on two wheels with the weight of its load and the trailer's weird angle.

The driver checks himself for injuries, then walks around the wreck. "Thank God," he thinks. "The load seems fine." He gets on his cell phone and calls 911, reporting the accident to Ely's highway patrol. Then he digs flares out of the cab and proceeds to mark off the crash site.

It is eighty miles to Ely; the highway patrol instantly contacts the Yucca Mountain site, informing them of an accident and possible breach of environmental security. It is a six hour drive--a two hour flight from Yucca Mountain to the crash site. The snow continues as the patrolman rushes as fast as the deadly-slick road permits to pick up the driver.

What no one knows is if the plutonium is secure. In fact, a crack in the container is already emitting radioactivity into the air. Particles are carried by the snow to the ground, where they freeze into the already thick layer of ice; particles remain airborne.

Shortly a car carrying a family comes along. Despite the trucker's warning to stop and not near the crash, they are impatient, afraid that they will be in too much danger, so they plow through, taking particles with them. Of course, the trucker is generally armed, but by the time he slip-slides from where he has been setting flares, the car has driven out of range, and he can't see it well anyway.

With plutonium continuing to leak, an ecological disaster is in the making.

I could go on with this insane scenario; however, you people on this panel know more than I about why you have chosen to do absolutely nothing about putting White Pine County's concerns into the EIS.

Response
This Comment-Response Document addresses the concerns raised in all comments submitted on the Draft EIS, including those from White Pine County. In many cases, comments have resulted in changes to the EIS. For example, to analyze the potential for impacts that could affect environmental resources, DOE collected and considered large amounts of information including information provided by the State of Nevada and counties in the State. For the analyses, DOE used information that it judged to be relevant and reasonable. For example, based on comments submitted during scoping hearings for the EIS, DOE added consideration of the Caliente-Chalk Mountain Corridor and Caliente/Chalk Mountain heavy-haul truck route. In response to public comments on the Draft EIS DOE used projections of population growth in Nevada provided by Clark and Nye Counties and the Nevada State Demographer for updated information presented in the Final EIS. DOE reviewed many documents produced by Lincoln County and other county and State agencies. The transportation-related information contained in those documents was considered for inclusion in the EIS. Nevada highway traffic information was collected from the Nevada Department of Transportation (DIRS 103405-NDOT 1997). DOE obtained and used accident rates for Nevada highways from the Department of Motor Vehicles and Public Safety, State of Nevada (see Section J.1.4.2.3 of the EIS). DOE also used information contained in a report prepared for the City of North Las Vegas (DIRS 155112- Berger Group 2000). The information in this report provided DOE with an estimate of the cost of advancing completion of the Las Vegas Beltway for use by heavy-haul trucks, an estimate of the populations that might live along the Beltway, and a basis for estimating the dose to a maximally exposed individual in a Nevada community from transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mountain. DOE used information contained in *The Statewide Radioactive Materials Transportation Plan, Phase II* to identify potential alternative highway routes for shipments of spent nuclear fuel and high-level radioactive waste that the State of Nevada has considered in the past (DIRS 103072-Ardila Coulson 1989).

8.10 (843)
Comment - EIS000173 / 0009
In one hour a legal, undamaged cask puts out gamma rays equivalent to 10 chest x-rays to those 6 feet away, and the surface of the cask puts out 10 times this much. Would you like to be in the car next to truck with such a shipment of casks stuck on the interstate for four to six hours like the vehicles on I-85 on October 19?

Response
As discussed in Section J.1.3 of the EIS, U.S. Department of Transportation Regulations (49 CFR 173.441) limit the dose rate from the side of a transport vehicle to 10 millirem per hour at 2 meters (6 feet). The radiation dose from standing 2 meters from a spent nuclear fuel cask for 1 hour is about equivalent to about one chest X-ray, not 10. The impacts to an individual in a traffic jam near a cask [assumed to be only 1.3 meters (4 feet) away] are listed in Table 6-9. The probability of a latent cancer fatality from this exposure is about 1 in 50,000. For perspective, the probability of a latent cancer fatality from all causes ranges from about 1 in 4 to 1 in 5.

8.10 (1069)
Comment - EIS000287 / 0002
Maintaining 77 sites is more hazardous than one. This is not taking into consideration that numerous communities along transport lines will have no protection against an accident. The DOE also asserts that this is cost efficient. Have they interpreted the costs of millions of additional cancer patients as a result of an accident or prolonged exposure due to routine shipping?

Response
Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel or high-level radioactive waste. The training of public safety officials would cover procedures required for safe routine transportation of these materials and for dealing with emergency response situations. Therefore, communities along transport routes would not be left unprotected. Section M.6 of the EIS provides more details on Section 180(c).

Neither the routine shipping or transportation accidents are expected to result in millions of additional latent cancer fatalities. For the Proposed Action, the analyses summarized in Table 2-9 of the EIS estimate that there could be about 3 latent cancer fatalities from the routine shipping of spent nuclear fuel and high-level radioactive waste over the 24-year campaign. For transportation accidents, the analyses in Section 6.2.4 estimate that there is a 2.3 to 2.8 in 10 million probability of a maximum reasonably foreseeable accident per year. Should the accident occur, the impact to the population would be about 5 latent cancer fatalities. For perspective, Section J.3.5.1 states that there would be about 220,000 cancer fatalities in a population of 1 million people along the transport routes from other causes besides the transport of spent nuclear fuel and high-level radioactive waste.

8.10 (1082)
Comment - EIS000232 / 0003
The impact on the national transportation system is further underestimated in the DEIS by the failure to include the fact that reusable shipping containers (casks) and the trucks or trains that deliver them to Yucca Mountain are going to have to return for another load. This means that Tables J-11, J-12, J-13 and much of the information extrapolated from them is going to have to be revised upwards. Table 2-7 indicates that normal traffic accident risks are very high, relative to the radiological risks (95%). Therefore, if the number of miles traveled doubles, the estimates of transportation risks will almost double without regard to the casks being empty or full.

Response
The EIS includes the mileage for empty return shipments in its calculation of traffic accident risks. For example, in Section 6.2.4.2.1 of the EIS, the subsection on Impacts from Traffic Accidents states that the fatalities would be primarily from traffic accidents; half would involve trucks transporting loaded casks to the repository and half would involve returning shipments of empty casks.

8.10 (1085)
Comment - EIS000232 / 0006
The risks listed in the DEIS throughout section J, list only fatalities as a consequence of transportation. A responsible risk assessment should also include maiming, permanent, partial and long-term disabilities, illness, lost workdays, etc., as they are surely part of the risk the nation will assume as you undertake this project.

Response
The transportation analyses for Nevada provided in Section 6.3 of the EIS presents the radiological and nonradiological impacts for comparing the Proposed Action and the No-Action Alternative. Traffic fatalities were

used as the measure of impact because they can be combined with radiation-related latent cancer fatalities to yield an estimate of the total number of fatalities for the Proposed Action and the No-Action Alternative. In contrast, combining traffic-related injuries with radiation-related latent cancer fatalities or radiation detriment would not yield an easily understandable estimate of total impacts.

8.10 (1123)
Comment - EIS000270 / 0004
DOE has inadequately characterized the impacts of transportation accidents and public health risks along designated nationwide routes. Using shipment numbers as listed in the DEIS and highway routing studies prepared by the UNLV Transportation Research Center, the State of Nevada has developed a preliminary estimate of potential legal-weight truck shipments through Colorado and Wyoming to Nevada.

Under the mostly truck scenario, there would be about 35,350 shipments through Denver over 39 years. To state this in another way, there would be an average of 2.5 truck shipments per day of highly radioactive material on I-70 through Denver every day, seven days a week, for as many as 39 years.

In 1995, Mr. Robert Halstead, a consultant for Nevada's Agency for Nuclear Projects, commented at the Scoping meeting held in Denver that "Colorado is an example of a state which would much more heavily affected by DOE's proposed multipurpose canister (MPC) base case." Mr. Halstead also stated during the 1995 hearing that Colorado reviewers of the EIS would have "No basis for evaluating the range of potential transportation impacts on unique local conditions." It was Sierra Club's concern then, as it is now, that high-level nuclear waste shipments traversing Denver and moving through the Eisenhower/Glenwood Tunnels is a dangerous, foolhardy enterprise as well as a significant public health hazard.

For this most recent hearing, Mr. Halstead has estimated that almost 9,100 rail shipments of highly radioactive material would move through Colorado and Wyoming over 39 years, an average of about 4.5 cask-shipments per week, and every week, for 39 years. Almost all of the rail shipments would follow the Union Pacific mainline from Gibbon, Nebraska to Salt Lake City through northeastern Colorado and southern Wyoming. Shipments from one reactor in Illinois would use the former Southern Pacific route through Grand Junction.

In addition, there would also be a considerable number of legal weight truck shipments through Colorado under the current capabilities scenario. Approximately 12,660 truck shipments would travel through Colorado on I-70, an average of 6.2 shipments per week, every week, for 39 years.

Sierra Club is not only concerned with radiation exposure to truckers, travelers, and those who live and work along the route, but accidents that will occur during shipment of this highly radioactive waste.

Response
Appendix J of the EIS has been revised to include maps of truck and rail routes used in the analysis, the number of shipments, and the impacts for each state through which spent nuclear fuel and high-level radioactive waste transport was analyzed. The estimated number of shipments and the radiological impacts are listed in Table J-75. These are estimates for analyzing transportation impacts in the EIS, and the actual routes, the number of shipments, and impacts for Colorado could be different depending on the actual routes chosen.

The shipping casks used to transport these materials would be massive, with design features that complied with strict regulatory requirements to ensure that the casks themselves were fault-tolerant; that is, the casks would perform their safety functions even when damaged. Numerous tests and extensive analyses, using the most advanced analytical methods available, have demonstrated that these types of shipping casks would provide containment and shielding even under the most severe kinds of accidents. Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there could be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be

extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

8.10 (1202)
Comment - EIS000306 / 0003
Also the plan to transport the waste an average of 2,000 miles from the reactors -- the average distance of the reactors to Yucca Mountain is 2,000 miles. And I didn't realize until tonight that they're taking a northern route along routes that are subject to snow and ice. I knew that Yucca Mountain was subject to snow and ice about eight months out of the year, a winding, narrow, mountain road where the trucks could easily fall off and the casks get opened or a diesel fire.

Response
As discussed in Section 3.1.2.2 of the EIS, the winter season in the Yucca Mountain region is mild, with mean temperatures ranging from 1.11ºC (34ºF) to 10.6ºC (51ºF) and precipitation ranging from 10 to 25 centimeters (4 to 10 inches) per year. Therefore, it is unlikely that Yucca Mountain would be subject to snow and ice for 8 months of the year.

Truck shipments to Yucca Mountain probably would take U.S. 95 and Lathrop Wells Road or Jackass Flats Road (see Figure J-10 in the EIS). These roads are not winding, narrow, mountain roads. Drivers would be required to maintain contact with the carrier dispatcher at regular intervals. In addition, DOE would use the TRANSCOM satellite system to track each shipment continuously, making it possible to adjust the routes or direct the driver to a safe haven if required. Section M.3 discusses protocols for dealing with adverse weather and road conditions. For example, the Regional Servicing Contractor would get information on weather and road conditions as part of preshipment planning. If weather conditions at the time of departure were not acceptable, the shipment would be delayed. While en route, the driver would receive reports of adverse conditions from the control center.

8.10 (1261)
Comment - EIS000228 / 0005
Section 1502.22 of the NEPA [National Environmental Policy Act] calls for agencies to disclose the unavailability of information in evaluating reasonably foreseeable significant adverse effects on the human environment. The absence of safety performance data for any component of the transportation system needed to move waste from generator sites to Yucca Mountain is a major gap in available information. Historic accident rates cannot necessarily be applied to the equipment used in the proposed action because the equipment has not yet been fabricated let alone tested and deployed operationally. The DEIS describes some areas where gaps in information exist, but does not make these gaps clear. Sections of the DEIS where there are gaps in information should be highlighted and the implications these gaps have on the validity of the conclusions of the DEIS thoroughly discussed.

Response
DOE does not lack safety performance data for the proposed transportation system. Spent nuclear fuel and high-level radioactive waste could be shipped in several configurations, all of which would require shipment in a shipping cask designed to existing standards established by the Nuclear Regulatory Commission. The Commission has developed an extensive body of empirical data on the performance of shipping casks designed for the safe transport of spent nuclear fuel and high-level radioactive waste. Casks have been placed on high-speed trains and smashed into solid concrete structures, immersed in high-temperature fires, and submerged underwater to verify empirically that they meet their rigorous design standards.

DOE believes that the EIS adequately analyzes the environmental impacts that could result from the Proposed Action. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist. The use of widely accepted analytic tools, latest reasonably available information, and cautious but reasonable assumptions offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

8.10 (1316)
Comment - EIS000165 / 0001
I don't have the heart to tell my son that the trains he loves so much may be carrying things that could shorten his life or even kill him. A photo was taken a few years back of a cask sitting on the track right next to our house. It sat there for several hours. There was no security protecting it. A radiation reading taken nearby showed a level of 10 background. The levels of radiation that Tendal and I would be exposed to would have a significant impact on the total amount of radiation we would be exposed to over the course of our lives. Even if an accident weren't to happen, our lives would be shortened.

Response
As discussed in Section 6.2.3 of the EIS, over the 24 years of shipments associated with the Proposed Action, the collective radiation dose to members of the public was estimated to be about 2,400 person-rem or an average of 100 person-rem per year. For the average person along a transportation route, the radiation dose from the shipments would be about 3 millirem per year, while the individual radiation dose from background radiation is about 300 millirem per year. Therefore, the radiation dose from the shipment of spent nuclear fuel and high-level radioactive waste would not appreciably increase the total amount of radiation that a person would be exposed to over a lifetime and would not be likely to shorten a person's life.

8.10 (1798)
Comment - EIS000312 / 0002
We also have some broad concerns about public health impacts associated with an accident. And given the limited time here to comment, I want to raise a particular issue. We ask that the Department of Energy address findings that are available in a report done by Dr. Ed Lyman of the Nuclear Control Institute which, as we understand, compares releases from the proposed mixed oxide fuel program in the Department of Energy, compares that to releases from the uranium fuel. And it does it in the context of an accident, and I understand that his findings related to accidents show two times more latent cancers from the release of MOX, mixed oxide fuel particles, than from regular irradiated fuel. And we've got your Department and folks, certainly, from the Aiken and Augusta area that are working very hard; and some folks in that area are inviting this program to be started at Savannah River site. So we urge you to incorporate in your assumptions what this would do in terms of the public health impacts.

Response
The report referred to by the commenter discusses severe nuclear reactor accidents involving mixed-oxide fuel, not transportation accidents. Severe nuclear reactor accidents involving mixed-oxide fuel are beyond the scope of this EIS. In addition, less than 1 percent of the shipments to the repository would consist of mixed-oxide spent nuclear fuel, so shipping it to the repository would not appreciably increase the overall risk of shipping spent nuclear fuel to the repository.

8.10 (1928)
Comment - EIS000467 / 0003
I wanted to address the lack of realistic accident scenarios. Right here in Washington, D.C. we are on the transport route of 146 rail casks projected from the North Anna Nuclear Plant on the CSXT rail line that passes right through Union Station, along the Metro stations, through Silver Spring. This was the very same tracks where the Amtrak and MARC trains collided in 1996, the deadly and fiery crash. So accidents do happen. CSXT was found partly responsible for this accident because they had removed safety sensors on the rail lines.

Response
As discussed in Appendixes J and M, most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask in a river, and similar extreme accident conditions, would not likely result in release of radioactive materials from the shipping casks. If a spent nuclear fuel rail cask had been on the CSXT train that collided with a commuter train in 1996, the accident conditions would not have been more severe than the design standards for the cask. No release of radioactive materials from the cask would have been expected. The performance standards for the casks prescribed by the Nuclear Regulatory Commission were selected to ensure that less than 1 percent of real-world accidents would result in loss of cask integrity and release of radioactivity from the cask. These standards ensure that the casks would be extremely robust.

As stated in Section J.1.4.2.2 of the EIS, accident rates used in the EIS are state-specific rail accident involvement and fatality rates based on statistics compiled by the Federal Railroad Administration for 1994 through 1996. Rail accident rates include both mainline accidents and those occurring in railyards. Therefore, realistic accidents such as the one described by the commenter were included in the analysis. More details on transportation accident data are provided in Section J.1.4.2.3.

8.10 (1992)
Comment - EIS000516 / 0004
What is the modeling that you used to come up with your transportation prediction for safety? And why weren't armed guards taken into account for transporting nuclear waste? Why wasn't human error taken into account for transporting this waste? Human error is the most dangerous of all, the most unforeseen, and any kind of safe systems modeling will take this into account. Why is there no inspection and maintenance required for this transportation?

Response
As discussed in Section 6.2.1 of the EIS, state-of-the-art transportation routing and dose assessment computer codes were used to estimate the impacts from transporting spent nuclear fuel and high-level radioactive waste.

The CALVIN computer program was used to estimate the numbers of shipments of spent nuclear fuel from commercial sites. This program uses information on spent nuclear fuel stored at each site and an assumed scenario for picking up the spent nuclear fuel from each site. The program also uses information on the capacity of shipping casks that could be used.

The HIGHWAY computer program is a routing tool used to select existing highway routes that would satisfy U.S. Department of Transportation route selection regulations and that DOE could use to ship spent nuclear fuel and high-level radioactive waste from the 77 sites to the repository.

The INTERLINE computer program is a routing tool used to select existing rail routes that railroads would be likely to use to ship spent nuclear fuel and high-level radioactive waste from the 77 sites to the repository.

The RADTRAN 5 computer program is used to estimate the radiological dose risks to populations and transportation workers of incident-free transportation and to the general population from accident scenarios. For the analysis of incident-free transportation risks, the code uses scenarios for persons who would share transportation routes with shipments—called onlink populations, persons who live along the route of travel—offlink populations, and persons exposed at stops. For accident risks, the code evaluates the range of possible accident scenarios from high probability and low consequence to low probability and high consequence.

The RISKIND computer program is used to estimate radiological doses to maximally exposed individuals for incident-free transportation and to populations and maximally exposed individuals for accident scenarios. To estimate incident-free doses to maximally exposed individuals, RISKIND uses geometry to calculate the dose rate at specified locations that would arise from a source of radiation. RISKIND is used to calculate the radiation dose to a population and hypothetical maximally exposed individuals from releases of radioactive materials that are postulated to occur in maximum reasonably foreseeable accident scenarios.

Sections 6.2.2, 6.2.3, and 6.2.4 of the EIS discuss the impacts of loading operations, incident-free transport, and accidents, respectively, including workers, inspectors, and guards. Details of the impacts to armed guards (security escorts) were included in the transportation analysis. This is discussed in more detail in Section J.1.3.2.1.

Accidents of all causes, including accidents caused by human error, were used to estimate the impacts from transporting spent nuclear fuel and high-level radioactive waste. Therefore, human error was included in the analysis of transportation impacts. More details on transportation accident data are provided in Section J.1.4.2.3 of the EIS.

Inspections of spent nuclear fuel and high-level radioactive waste shipments would be performed. For example, trucks would have to pass the Commercial Vehicle Safety Alliance enhanced safety inspection, which includes a

radiological survey and stringent examination of all driver, vehicle, and hazardous material requirements. More details on transportation regulations, including those that address inspection, can be found in Section M.2 of the EIS.

Maintenance would be required. For example, Section M.3.2.1.6 of the EIS describes a Carrier Management Plan, which includes a maintenance program.

8.10 (2266)
Comment - EIS000394 / 0003
As we have noted in the past, however, explicit treatment of post-accident protective measures, such as interdiction of contaminated properties and the embargo of contaminated crops, would make the document stronger, and would provide state and local officials and members of the public with a more complete picture of the radiological consequences of major transportation accidents. As we also have commented previously, we would like to see recovery issues, such as decontamination, re-entry, and return, explicitly addressed in the EIS.

Response
In response to public comments, DOE has included a discussion on the costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Eas (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its public comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities. Although the studies project high costs for clean up following severe accidents, the accidents evaluated are very unlikely and, as a consequence, DOE believes the economic risks of transportation accidents would be very small.

8.10 (2398)
Comment - EIS000674 / 0001
The Draft Environmental Impact Statement is deficient in its treatment of the safety aspects of heavy-haul trucks.

If you use, for example, Nevada average accident rates and the projected shipment miles for DOE's top Module 2 scenario and you look at the Caliente route, you come to the conclusion that you've got a projection using those historical numbers of about 24 accidents, 12 loaded, 12 unloaded over 39 years. There could be more, there could be less.

The point is when you start doing risk analysis, you do a baseline, and if the historical trends hold into the future, you can assume there will be accidents, and that's assuming that the heavy-haul trucks are as safe as other traffic.

So I don't see any basis in the DEIS. There's no empirical evidence to support their conclusion quote that the accident risks are low for all five route alternatives.

Response
The EIS acknowledges that transportation accidents could occur during the transport of radioactive materials to the proposed Yucca Mountain Repository. In Section J.1.4.2.3.2, the EIS estimates that there could be as many as 66 accidents under the mostly legal-weight truck shipping scenario and 2 accidents could occur under the mostly rail scenario. A study recently conducted by Sandia National Laboratories concluded that only a tiny fraction of all accidents, less than 1 in 10,000, would be severe enough to result in a failure of a spent nuclear fuel shipping cask (DIRS 152476-Sprung et al. 2000). The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. Based on these statistics, DOE does not expect an accident to occur that would involve radiological consequences. Similarly, DOE does not expect an accidental release to occur on any of the five heavy-haul truck routes.

To place these risks in perspective, DOE compared the risks of fatalities from traffic accidents involving shipments of spent nuclear fuel and high-level radioactive waste to the expected fatalities on U.S. highways over the 24 years of the Proposed Action (see Section 6.2.4.2.1 of the EIS). Although this comparison is based on the national transportation impacts, it is illustrative of Nevada transportation impacts. The EIS states that approximately four fatalities could occur under the mostly legal-weight truck scenario during the 24 years of the Proposed Action. This

can be compared to the approximately 1 million traffic fatalities projected to occur over that same period from all traffic accidents on U.S. highways. Based on this comparison and comparisons of other transportation impacts to commonly accepted risks, DOE concluded that the transportation risks would be low.

DOE used available, heavy-combination, legal-weight truck traffic accident statistics for heavy-haul truck accident rates. While DOE agrees heavy-haul truck shipments could be obstacles to traffic due to their length and slow transit speeds, special precautions would be taken improve the safety of heavy-haul truck shipments. These special precautions include restricting movement to daylight hours and requiring escort vehicles to warn other drivers of the slow-moving vehicles. In addition, DOE proposes a number of improvements to the candidate heavy-haul truck routes to improve traffic flow and safety, such as providing truck passing lanes, improving road surfaces, and widening shoulders. Based on the special precautions and the proposed improvements to heavy-haul truck routes, DOE is confident that heavy-haul trucks carrying spent nuclear fuel and high-level radioactive waste shipping casks can be operated safely.

8.10 (2849)
Comment - EIS000871 / 0001
The most important thought that comes to mind when I hear that nuclear waste being transported over the railways is derailment which we just had a coal train derail in Belleville Illinois a few days ago. How good are the rails from coast to coast? Is it even safe to transport the waste over the interstate highway systems with the many road ragers out there? In a radius of 50 to 100 miles a million or more lives may be at stake.

Response
Safety is DOE's primary concern when shipping all types of radioactive material, including spent nuclear fuel and high-level radioactive waste. Section 2.1.3.2 of the EIS states that DOE would comply with applicable regulations of the U.S. Department of Transportation and Nuclear Regulatory Commission regulations. Both agencies strictly regulate all aspects of radioactive material transportation, including packaging (casks), transporting, and handling radioactive materials for all modes of transportation, and include standards for inspection, labeling, shipping papers, placarding, loading and unloading, allowable radiation levels, and limits for contamination of packages and vehicles, among other requirements. In addition, the regulations specify training for personnel who perform handling and transport of hazardous materials, liability insurance requirements for carriers, and safety requirements for vehicles and transport operations. DOE would implement all applicable regulations, including its own, through its Regional Servicing Contracts as described in the draft Request for Proposals for these services (DIRS 153487-DOE 1998). More details on DOE and other agency transportation regulations can be found in Section M.2 of the EIS.

8.10 (3311)
Comment - EIS001085 / 0001
The potential collective long term risk from direct exposure to ground contamination and from ingestion pathways through food and soil contamination should be included in RADTRAN4 transportation accident analyses. In agricultural areas the collective risk from ingestion pathways could be substantially greater than the inhalation pathway. The input parameters such as the food transfer factors (ACCDNT (6,k)), soil transfer factors (ACCDNT (6, k)) and cleanup level (CULVL) used in RADTRAN4 calculations should be provided. The value of cleanup level should be estimated based on a comprehensive pathway analysis including all pathways of exposure, all nuclides of radiological significance and all weather conditions (all 6 or 7 meteorological categories).

Response
Appendix J of the EIS describes the exposure pathway analysis used in the calculation of transportation accident risks. The analyses performed using RADTRAN 5 included inhalation, air immersion, direct exposure to ground contamination, and ingestion pathways. Input parameters such as dose conversion factors, food transfer factors, and soil transfer factors are available on the Yucca Mountain EIS Transportation Calculation Package, which is part of the EIS Administrative Record.

8.10 (3488)
Comment - EIS000688 / 0002
You're sitting here just a few meters from the railroad tracks over which you propose to transport high-level nuclear waste.

Now, transport yourself back in time to New Year's Eve 1910. Flood waters would be twisting those railroad tracks into pretzels. Millions of tons of rock would be raining down from the hillsides on to the railroad, and you would be sitting up to your necks in mud the consistency of pancake batter.

Response
As discussed in Sections 6.2.4.2 and J.1.4.2.1 of the EIS, the accident analyses included a maximum reasonably foreseeable accident. This accident is more severe than would likely occur in real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask in a river, and similar extreme accident conditions. The performance standards for the casks prescribed by the Nuclear Regulatory Commission were selected to ensure that these real-world accidents would not likely result in release of radioactivity from the cask. These standards ensure that the casks would be extremely robust.

8.10 (3489)
Comment - EIS000719 / 0001
The Draft EIS falls shy of adequately considering the impacts of transporting the waste materials to Yucca Mountain. The DOE notes that the region of influence for public health and safety along existing transportation routes is a half mile from the center line of transportation rights-of-way for non-accident conditions, and 50 miles for accident conditions (p. 3-98).

However, the DEIS neither shows specific routes outside of Nevada to be used to transport waste materials, nor addresses the baseline conditions along those routes. In order to do a complete impact analysis, the DOE should map specific routes and establish baseline conditions along those routes, as well as clearly and honestly identify potential impacts along those routes.

One can look at a map of the current locations of radioactive waste to see that this highly irradiated waste will need to ravel through 43 states-past the homes, workplaces, and hospitals of 50 million Americans to get to Yucca Mountain. Those 50 million Americans have a right to be informed about the risk associated with transporting nuclear waste and the impacts on public health and the environment that will occur from the transportation.

The DEIS should clearly and accurately characterize the risks involved along the transportation routes, and it should use the most current information available to do so. Further, it should include site-specific data to show the effects of accidents in highly populated areas or areas where it would be difficult to retrieve a leaking cask (such as ravines and rivers).

Response
In response to public comments, DOE has included maps of the highway routes and rail lines it used for analysis in the EIS (see Section J.4). It also included potential health and safety impacts associated with shipments for each state through which shipments could pass.

Based on the results of the impact analyses presented in Chapter 6 and Appendix J of the EIS, as well as the results published in numerous other studies and environmental impact analyses cited in the EIS, DOE is confident spent nuclear fuel and high-level radioactive waste can be and would be safely transported to Yucca Mountain. DOE believes, as the EIS reports, that the potential impacts of this transportation would be so low for individuals who live and work along the routes that these individual impacts would not be discernible even if the corresponding doses could be measured. The analysis presented in the EIS factored in the characteristics of spent nuclear fuel and high-level radioactive waste, the integrity of shipping casks that would be used in transport, and the regulatory and programmatic controls that would be imposed on shipping operations (see Appendix M). The EIS analytical results are supported by numerous technical and scientific studies that have been compiled through decades of research and development by DOE and other Federal agencies of the United States, including the Nuclear Regulatory Commission and the U.S. Department of Transportation, as well as by the international community, including the International Atomic Energy Agency.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as

well as the choice among alternative rail corridors in Nevada, if the site was approved. See the introduction to Chapter 8 of this Comment-Response Document for additional information.

DOE does not believe it necessary to consider population characteristics on a community-by-community basis to determine potential public health and safety impacts from the transportation of spent nuclear fuel and high-level radioactive waste. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions if there are uncertainties, offers the most appropriate means to arrive at conservative estimates of transportation-related impacts.

With respect to a shipping cask falling into a river, the EIS does not specifically analyze a transportation accident involving contamination of surface water or groundwater because previous EIS analyses have consistently shown that the airborne pathway has the greatest potential for exposing large numbers of people to radioactive material in the event of a severe transportation accident. Ostmeyer (DIRS 157052-1986) analyzed the potential importance of water pathway contamination for spent nuclear fuel transportation accident risk using a worst-case water contamination scenario. The analysis showed that the impacts of the water contamination scenario would be about one-fiftieth of the impacts of a comparable accident in an urban area. A water contamination scenario could affect groundwater resources, but to much lower levels of contamination than surface water because of the delay associated with the infiltration of meteoric water to groundwater. Therefore, the results of the analysis indicate that water pathway contamination would not be a significant contributor to the radiological risks of transporting spent nuclear fuel.

With respect to recovering a shipping cask that falls into a ravine or river, the transportation carrier involved in an accident would be responsible for planning, cost, and arrangements necessary to safely recover the shipment and clean up any radioactive contamination that could occur (see Section 6.2.4.2 of the EIS). Recovery of 23-metric-ton (25-ton) truck casks or rail casks weighing 110 metric tons (120 tons) is not an easy operation, especially in areas where deploying mobile carriers is difficult. However, capability to lift such weights does exist for rail and truck modes and would be deployed as required in the unlikely event of a cask leaving the conveyance or transport vehicle.

8.10 (3608)
Comment - EIS001031 / 0013
What are you going to do when a truck or train crashes? What funding is provided to local communities for equipment and training for a high level radioactive accident/emergency? If there is an accident, how large an area could be affected?

Response
In response to public comments, DOE has provided additional information on emergency response activities following transportation accidents (see Section M.5 of the EIS). Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel or high-level radioactive waste. The costs of providing this technical assistance and training have not yet been determined but the funds would come from the Nuclear Waste Fund. According to the Notice of Revised Proposed Policy and Procedures published in the *Federal Register* (63 *FR* 23753, April 30, 1998), a one-time planning grant of $150,000 would be provided to eligible states and tribal jurisdictions for the determination of training and funding needs and for preparation of the application for funds about 4 years before shipments began.

State and local governments deal with transportation accidents involving hazardous materials on a daily basis across the United States. According to the Notice of Revised Proposed Policy and Procedures (63 *FR* 23753, April 30, 1998), DOE would provide funding and technical assistance to eligible jurisdictions along transportation routes to address incremental training requirements resulting from shipments of spent nuclear fuel and high-level radioactive waste to the repository. DOE would allow a variety of activities an applicant state or tribal jurisdiction might consider appropriate for training under the Section 180(c) program. Along a specific transportation route, it would be the applicant's decision as to who received training.

The DOE Radiation Emergency Assistance Center/Training Site has been working with state and local groups, including hospitals, to provide medical emergency response training, as well as providing treatment and medical

consultation for injuries resulting from radiation exposure and contamination. Among the training courses conducted are courses in the handling of radiation accidents by emergency staff, and medical planning and care in radiation accidents.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10 (3782)
Comment - EIS001244 / 0004
The DEIS must consider the real impact of an accident along the route.

What will be the response of the local health and emergency personnel?

Are the relevant personnel trained for responding to an accident involving high level nuclear waste?

Is the medical establishment trained to treat patients exposed to high level nuclear waste?

What type of emergency preparedness is required to be in place to adequately respond to an accident involving high level nuclear waste?

Who will pay the cost of formulating such a plan and training all the emergency response and health professionals?

What are the economic impacts on the local economy if an accident occurs? This question applies to all communities along the transportation routes.

What are the direct economic impacts to families and businesses in the area of the accident during the emergency response?

What type of cleanup is required in the case of an accident involving the release of high level nuclear waste?
What are the stigma effects to property owners in the area of an accident?

What are the stigma effects to Las Vegas if we have an accident here? Our economy is based on tourism. Other destinations are available to individuals who would be reluctant to bring their families to a city which has experienced a nuclear accident. How long would the stigma of a nuclear accident impact the economy of our city? What happens to all non-tourist sectors of the economy if an accident involving nuclear waste in our city seriously undermines the tourist revenue of the region?

Response
Several of the questions in this comment requested more information on emergency preparedness. Two regulations address the commenter's concern. First, Section 180(c) of the NWPA requires DOE to provide funds for training emergency response personnel in eligible jurisdictions along selected transportation routes. Sections M.5 and M.6 of the EIS discuss these requirements in detail. Second, there is a Federal Radiological Program outlined in the Federal Radiological Emergency Response Plan and the Federal Radiological Monitoring and Assessment Plan. These plans outline the policies, procedures, roles, and responsibilities of Federal, state, local, and Native American tribal agencies in planning for and responding to emergencies involving releases or suspected releases of radiological materials from government and commercial facilities or operations. Under Section 180(c), DOE will fund eligible jurisdiction planning activities to determine current capabilities and needs, and will fund training for emergency response activities.

The purpose of Section 180(c) is to ensure that first responders are sufficiently trained to respond safely to an incident involving the shipment of spent nuclear fuel and high-level radioactive waste. DOE has committed to provide technical and financial assistance for training as mandated by Section 180(c) approximately 4 years before shipments would begin. In addition, the Emergency Planning and Community Right-To-Know Act mandates the formation of emergency planning and response capability by the states. The *Federal Register* notices make it clear that the funding will go to states and tribes. Local governments would not be eligible to receive Section 180(c) grants directly. However, states and tribes would have to coordinate their planning with local jurisdictions, indicating in the application that the needs of local public safety officials have been considered and how the training assistance would be provided to local jurisdictions and their public safety officials.

DOE recognizes that emergency preparedness capabilities and needs vary from jurisdiction to jurisdiction. To assist states and tribes in determining what their needs are and where the Section 180(c) funds and assistance can best be applied, DOE will provide a one-time planning grant to aid in making this determination. Appendix M of the EIS discusses Section 180(c).

In the event of an incident or accident involving radioactive materials, states, tribes, and local governments can request assistance from the Federal Government under the Federal Radiological Emergency Response Plan. Assistance is available from 17 different agencies. In addition, DOE maintains eight Regional Coordinating Offices across the country that are ready to provide assistance. Appendix M contains information about these resources.

The Regional Servicing Contractor would have to provide specific written procedures to drivers and crews that clearly defined detailed actions in the event of an emergency or incident. The draft Request for Proposals, *Acquisition of Waste Acceptance and Transportation Services for the Office of Civilian Radioactive Waste Management* (DIRS 153487-DOE 1998), focused on these and related responsibilities. Appendix M of the EIS discusses carrier and shipper responsibilities for emergency situations.

With regard to cleanup after a transportation accident, the Price-Anderson Act establishes a system of financial protection for the public in a nuclear accident (compensation for damages, loss, or injury suffered), regardless of who causes the damage. Section M.8 of the EIS discusses the Price-Anderson Act.

DOE would not make routing decisions for some years; such decisions would in accordance with U.S. Department of Transportation routing guidelines. According to the report *Identification of Factors for Selecting Modes and Routes for Shipping High-Level Radioactive Waste and Spent Nuclear Fuel* (DIRS 103718-DOT 1998), routing evaluations should consider such parameters as emergency response capabilities; local terrain, road design, and climate characteristics as they affect accident rates; economic effects of accidents; sensitive environments exposed; and locations of special facilities such as hospitals and schools.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 of the EIS included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

For perspective, the current insured limit of responsibility for an accident involving releases of radioactive materials to the environment is $9.43 billion. The annual cost of transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain would be about $200 million.

With respect to comments on perceived risk and stigma associated with potential transportation accidents, while stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as accidents, which would not be expected to occur. As a consequence, DOE addressed but did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Final EIS.

8.10 (3926)
Comment - EIS001287 / 0004
A single accident could have major ramifications for much of Ohio. The potential risk of a significant release of radiation, though statistically small, could be incalculably catastrophic. There are too many uncertainties with rail or highway transportation. Too many potential hazards exist: accidents, other drivers, weather problems, road or track problems, which could ultimately compromise safety.

The costs of any leaks or accidents will effect the environment we live in for thousands of years. A major accident would pose obvious risks in terms of cancer but it would also poison farmland, effect watersheds, and flora and fauna in the vicinity. And it appears that studies minimize the health effects on humans by only identifying the cancer risk, while ignoring other effects of radiation exposure. It is unconscionable to take such genetic, teratogenic, and environmental risks.

Response
The EIS contains a discussion of potential impacts from accidents in both the mostly legal-weight truck scenario and the mostly rail scenario (see Section 6.2.4.2). The accident analysis includes a description of the consequences of a severe accident that would result in a leak in a transportation cask, although that is an extremely unlikely event [an annual probability of 2.8 (rail) to 2.3 (truck) in 10 million]. The leaking of a transportation cask could only occur if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. Section M.4 contains more information on the safety and testing of transportation casks. The accident analyzed in the EIS is believed to cover accidents from all sources including heat, mechanical impacts, sabotage, impacts from airplanes and weapons, and mountain rollovers.

DOE, the U.S. Department of Transportation, and the Nuclear Regulatory Commission recognize that there are many uncertainties with rail or highway transportation. Many hazards–accidents, other drivers, weather problems, road or track problems—could compromise safety. To mitigate the potential for a release of radioactive materials caused by these uncertainties, the Federal agencies listed above have a myriad of regulation, if adequately implemented, to preclude any release of radioactive materials. These agencies take human behavior seriously and consider these factors in all that they do from selection and training of personnel to post transport evaluations (see Section J.1.4.2.1 of the EIS).

The location of the maximally exposed individual was assumed to be at the downwind distance that yielded the highest radiation dose. For analysis of the consequences of severe truck and rail accidents and acts of sabotage, the distance used was estimated using the RISKIND computer program (see Sections 6.2.4.2.1, 6.2.4.2.2, and 6.2.4.2.3 of the EIS). RISKIND calculates the atmospheric dispersion of radioactive materials downwind from the point of release and is used to estimate the downwind location where the dose would be greatest.

The risks of transportation accidents are discussed in Sections 6.2.4.2 and J.1.4.2 of the EIS. Table J-81 lists estimates of transportation risks for Ohio for the mostly truck and mostly rail transport scenarios. In estimating these risks, accidents caused by all sources, such as other drivers, weather problems, and road or track problems, were included. The analysis addressed a variety of exposure pathways for air submersion, to food consumption, to direct radiation from materials deposited on the ground. Federal agencies have concluded that the protection of humans provide sufficient protection for flora and fauna. Therefore, latent cancer fatalities is a clear measure for comparing implementing alternatives.

The EIS uses the risk of a latent cancer fatality as its primary measure of radiological impact. However, other radiation-related impacts such as the incidence of nonfatal cancers and severe genetic effects are discussed in Section F.1.1.5 of the EIS. All radiation effects are linear with latent cancer fatalities and including these other radiation-related impacts would increase the total detriment from radiation exposures by about 50 percent.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report (DIRS 154814-Sandquist et al. 1985) used in the 1986 Environmental Assessments, and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies

involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10 (4057)
Comment - EIS001474 / 0006
Just a couple weeks ago a low-level waste shipment in Ohio was involved in a head-on collision and there was a big fire involved. And I'll be interested to see what kind of releases were involved in that.

Response
Greater-than Class C low-level radioactive waste could be shipped to the repository in Module 2. However, the impacts for spent nuclear fuel accidents would generally be larger than accidents involving greater-than-Class-C waste, because the amount of radioactivity contained in a spent nuclear fuel cask would be much larger.

As discussed in Appendixes J and M, most real-world accidents that have been postulated for spent nuclear fuel and high-level radioactive waste shipments, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask in a river, and similar extreme accident conditions, would not be likely to result in release of radioactive materials from the shipping casks. The performance standards for the casks prescribed by the Nuclear Regulatory Commission were selected to ensure that less than 1 percent of real-world accidents would result in loss of cask integrity and release of radioactivity from the cask. These standards ensure that the casks would be extremely robust.

8.10 (4082)
Comment - EIS001482 / 0004
And then I look in the DEIS, and this -- what do you call it -- a region of influence is only 50 miles on this thing. If you would have an accident on the highway, you would only consider it 50 miles. You know, that's ridiculous.

Response
The EIS estimates impacts from transportation accidents to the population living within 80 kilometers (50 miles) of the transportation route. Air modeling studies have shown that, in the event of a radioactive material release from a transportation accident, most of the radiation dose would go to the population within 80 kilometers. Although there could be small effects beyond 80 kilometers, the statistical uncertainty in the analytical models is too high at such distances to provide meaningful results.

8.10 (4296)
Comment - EIS001160 / 0105
Page 6-27: The assumptions underlying this section and related table are suspect. First, the assumption appears to be that the cask cannot be breached in any way, either by heat or physical forces. While the data presented here and in the supporting texts indicate the improbability of cask breach, they cannot rule it out. Rail casks, speared by a rail during accident would cause cask breach, extreme heat might damage seats, a terrorist act could breach the container, etc. Collective doses in these scenarios would be considerably higher than the data presented here. DOE should thoroughly rethink these hypotheses and present data that includes the potential for containment breach, along with the statistical probability of such an accident occurring. Second, distances from containers either during an accident or in subsequent clean up are not presented, either here or in Appendix J. It would be possible to skew data either up or down by adjusting the distance from radiation source. In other parts of this document (6.2.4.2.3 1 6, line 4-5) the assumed distance from source is 150 Meters (about 500 feet). Here again the data presented (if I understand the writer correctly) appears to disagree with data presented later on in the document on maximum exposure risks. Without knowing how this data was calculated, we cannot confirm or dispute the findings, and on the face of it, these exposure risks, associated with an accident appear artificially low.

Response
The EIS contains a discussion of potential impacts from accidents in both the mostly legal-weight truck scenario and the mostly rail scenario (see Section 6.2.4.2). The accident analysis includes a description of the consequences of a severe accident that would result in a leak in a transportation cask, although that is an extremely unlikely event [an annual probability of 1.4 (rail) to 1.9 (truck) in 10 million]. The leaking of a transportation cask could only occur if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. Additional information on the safety and test of transportation casks is provided in Section M.4. The

accident analyzed in the EIS is believed to cover accidents from all sources including heat, mechanical impacts, sabotage, impacts from airplanes and weapons, and mountain rollovers.

The location of the maximally exposed individual was assumed to be at the downwind distance that yielded the highest radiation dose. For severe truck and rail accidents, the distance used was 360 meters (1,200 feet) (see Sections 6.2.4.2.1 and 6.2.4.2.2 of the EIS). For sabotage events, the distance was 140 meters (460 feet) (see Section 6.2.4.2.3). The distances are different because different dispersion conditions would exist during severe accidents and sabotage events.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10 (4302)
Comment - EIS001160 / 0111
Page 8-79, Section 8.4.1. Inventory module 1 or 2 impacts, and Table 8-59. Some of the data reflected in this table does not seem to compute correctly. Specifically, a 58 percent increase in time spent shipping material reflects nearly 90 percent increase in kilometers traveled (580 million kilometers traveled vs. 1 billion kilometers traveled) with only a 50 percent increase in fatalities (8.6 to 12.9). The fatality rate per kilometer driven actually drops in the inventory module I or 2 scenario from the proposed action by about 20 percent. This doesn't seem logical. An argument that the kind of waste being transported is a consideration is not meritorious in as much as trucks must still travel the same highways and therefore would incur the same risks as other commercial trucking and have roughly the same number of accidents.

Response
The comment compared kilometers traveled and fatalities on the Totals line of Table 8-59 of the Draft EIS and noted a 90-percent increase in kilometers traveled resulted in only a 50-percent increase in fatalities. The data in the table actually compute correctly. Comparing each category in Table 8-59 separately, there is a consistent relationship between kilometers traveled and fatalities. For example, with the Materials category, there would be a 73-percent increase in kilometers traveled [130 million versus 225 million (80 million versus 140 million miles)] and a 68-percent increase in fatalities (2.5 versus 4.2). Taking rounding error into account, these percent increases are consistent. The same consistent relationship occurs for each category listed in Table 8-59. The apparent error appears only when attempting the same comparison on the Totals line. The same comparison cannot be made on the Totals line because the percent differences for each category are not additive; each category involves transportation along a specific set of routes with their own route-specific accident and fatality rates. If the route-specific accident and fatality rates happened to be identical for each category, the percent differences in data on the Totals line would be additive.

8.10 (4384)
Comment - EIS001523 / 0003
The EIS proposes either rail truck options for transportation of waste (Moore, 1). However, the DOE does not accurately assess the potential risk or probability of environmental damage or serious accidents resulting from either option. The EIS cited that the frequency of accidents on national interstate highways is not likely to change, despite a recent speed limit increase on these highways and gives no supporting evidence for its conclusion (Resnikoff, 3). The probability of accidents was also incorrectly calculated to be less than what is actually likely. The DOE does not include the effects of increased highway use in the Las Vegas and surrounding areas as a result of projected population growth. In assessing the potential danger of rail accidents, the DOE uses incomplete data by only assessing the risk resulting from a nuclear fuel falling from a low bridge and does not consider the consequences, which could result from an accident from a tall bridge (Resnikoff, 5).

Resnikoff, Martin. Cask Safety and related issues in the draft Yucca Mountain EIS.
http://www.state.nv.us/nucwaste/eis/yucca/rwmaymeis.pdf. Jan 26, 2000.

Moore, Rick. Rail Issues in the Draft EIS.
http://www.state.nv.us/nucwaste/eis/yucca/moore1a.pdf.
http://www.state.nv.us/nucwaste/eis/yucca/moore1b.pdf. Jan 26, 2000.

Response
DOE believes that the EIS adequately analyzes the environmental impacts that could result from the Proposed Action. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

For the reasons discussed above, DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada.

8.10 (4781)
Comment - EIS001519 / 0007
Transportation of the spent fuel is an extremely dangerous undertaking because of the cataclysmic destruction it would cause to the surrounding area of the crash site and the high probability of there being an accident. There were 382,030 accidents involving heavy load trucks in 1997, an average of about 1,047 per day. When taken together with the fact that it would take over 23 years to move all the spent fuel to the repository, it is difficult to accept the idea that over that long time span, there will be no accidents involving a nuclear waste Carrying truck.

Response
About 53,000 shipments are estimated for the mostly legal-weight truck scenario. Given the number of shipments, traffic accidents probably would occur, although DOE does not believe that any of the accidents would be severe enough to result in the release of radioactive material, primarily because of the structural integrity of the casks in which the material would be transported.

8.10 (4888)
Comment - EIS000337 / 0028
Pg. 6-17,18, Section 6.2, National Transportation: I understand the probability and if one goes back and examines the train wreck that spilled thousands of gallons of toxic material into the Sacramento River it probably is outside the limits for the model used by DOE. It only takes one to do significant damage. The difference between all the past accidents and one that could occur transporting nuclear waste is that past accidents were cured in one life time but the nuclear accident time to cure could extend over many life times. The reference section is again laced with adjectives that do not belong in an engineering document. If you can state it is not “likely” or “unlikely” or “very unlikely” state the probability. No place in this document did I find any comment on the nuclear waste that is imported with respect to quantity and route. Please provide the data to me.

Response
Probabilities of severe spent nuclear fuel accidents are presented in Section J.1.4.2.1 of the EIS. Over 24 years of truck shipments to Yucca Mountain there would be less than a 1-percent chance of an accident that could result in a release of radioactive material from a cask. The chance of a rail accident that would cause release from a cask would be even lower. The chance that such an accident would occur in any locale would be much less than 1 percent. Therefore, an accident such as the train derailment near the Sacramento River would not be likely to release radioactive materials from the casks into the river.

DOE would not import spent nuclear fuel or high-level radioactive waste from foreign countries for disposal in the proposed repository. However, the Department has agreed to accept certain shipments of spent nuclear fuel from foreign research reactors as discussed in *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DIRS 101812-DOE 1996). Such fuel would be shipped to an existing DOE site for interim storage before ultimate shipment to a repository. The description of DOE spent nuclear fuel in Appendix A of the EIS includes the characteristics of the foreign research reactor fuel. Figure A-1 shows the locations of the commercial and DOE sites from which materials would travel to the repository. Tables J-10 and J-11 list the highway and rail routes, respectively, that DOE analyzed for this EIS.

8.10 (4891)
Comment - EIS000337 / 0031
Pg. 6-28, block at the bottom of the page: DOE uses the argument that if the accident is not reasonable it is not analyzed. This is defined by conditions that occur more often 1 in 10 million times a year. They eliminate any conditions that occur less than that number. The public should be told of what can happen because if it can it will in the years that material is being transported.

Response
Environmental impact statements are not required to analyze worst-case accidents but they are required to analyze reasonably foreseeable accidents. DOE guidelines (DIRS 104601-DOE 1993) suggest that these include accidents with probabilities in the range of 1 in a million to 1 in 10 million per year. As discussed in Section 6.2.4.2 and J.1.4.2.1 of the EIS, the accident analyses in the EIS include these "maximum reasonably foreseeable accidents." In addition to accidents with a probability greater than 1×10^{-7} per year, the EIS presents the consequences from all accident severity categories presented in Sprung et al. (DIRS 152476-2000).

8.10 (5036)
Comment - EIS001520 / 0004
The analyses of the impacts of transportation accident should include estimates of the environmental impacts associated with cleaning up after any accidents that release radioactive materials to the environment.

The analyses of transportation accidents that result in releases of radioactive materials to the environment assume that the released materials are not cleaned up. While this assumption may provide a bounding estimate of the radiation doses that nearby residents could receive, it is unrealistic because it fails to estimate the environmental impacts of clean up (e.g., worker radiation exposure; condemnation of roads, land, or water supplies; disposal of contaminated soil and building materials). A methodology for make such estimates was presented in Transportation of Radionuclides in Urban Environs: Draft Environmental Assessment, NUREG/CR-0743; SAND 79-0369, July 1980. While somewhat dated, the cost estimates and perhaps the methodology could be updated for today's use. The Board recommends that the final EIS include estimates of the environmental impacts of clean-up after transportation accidents.

Response
In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10 (5043)
Comment - EIS001520 / 0011
The draft EIS uses the "Modal Study" (discussed on page 6/29 of the draft EIS) in its analyses of transportation accidents. It is our understanding that this study will be updated by the U.S. Nuclear Regulatory Commission, but not in time for inclusion in the final Yucca Mountain EIS. The Board recommends that the final EIS note any

efforts to update the study and discuss the DOE's plans for reviewing the results of any update to determine whether a supplement to the final EIS may be needed.

Response
Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). DOE has concluded that the models used for analysis in the Draft EIS relied on assumptions about spent nuclear fuel and cask response to accident conditions that caused an overestimation of the resulting impacts. Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there could be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 presents consequences for accidents that could release radioactive materials.

8.10 (5294)
Comment - EIS000968 / 0011
By not identifying specific routes for shipment, key issues were not addressed in the DEIS. For example, the Cal-Nev Fuel Pipeline runs parallel to the Union Pacific Railroad from the San Bernardino area into the Las Vegas Valley. These 14" and 9" fuel lines could cause significant impact in the event of a rail accident, and they are the main supply of all motor vehicle and aircraft fuels into Southern Nevada.

Response
"Real-life conditions" that would involve various types of collisions (such as airplanes and military trucks carrying explosives), various natural disasters, specific locations (such as mountain passes or near pipelines), or various infrastructure accidents (such as track failure) in effect constitute a combination of cask failure mechanisms, impact velocities, and temperature ranges, which the EIS does evaluate. Shipping casks used to transport spent nuclear fuel and high-level radioactive waste would be massive, with design features that complied with strict regulatory requirements to ensure that the casks were fault-tolerant; that is, the casks would perform their safety functions even when damaged. Numerous tests and extensive anlyses, using the most advanced analytical methods available, have demonstrated that these types of shipping casks would provide containment and shielding even in the most severe kinds of accidents.

Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses in this report, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in 99.99 percent of all accidents (of the thousands of shipments over the past 30 years, none has resulted in an injury due to release of radioactive materials). The analysis in the EIS used data presented by Sprung et al. (2000) and state-specific accident rates (DIRS 103455-Saricks and Tompkins 1999) to estimate the likelihood and severity of transportation accidents. The data from these studies are based on national data collected from actual accidents. The national data include accidents in which road hazards and other local conditions (such as pipeline failures) were contributing factors.

The analysis in the EIS estimated that during the approximately 53,000 truck shipments for the mostly legal-weight truck scenario there could be 66 accidents. Each of these would have less than a 0.1-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

8.10 (5708)
Comment - EIS001887 / 0323
Page 6-30; Box - Transportation Accidents

The Draft EIS incorrectly assumes that simply requiring contractors to comply with ANSI N14.27-1986-1993) will guarantee timely availability of the trained personnel and special equipment necessary for recovery and reshipment of casks damaged in severe accidents. In particular, DOE must demonstrate the economic and technical feasibility

of recovering and re-shipping large (125 tons or greater loaded weight) rail casks such as those proposed for transport of civilian and naval reactor SNF [spent nuclear fuel]. The analysis must consider the possibility of significant loss of shielding and/or containment as a result of a severe accident or terrorist attack. The analysis must further consider the possibility of such incidents occurring in difficult terrain comparable to that found along potential rail routes identified in the Draft EIS, such as the Union Pacific railroad between Uvada and Elgin, and along potential HHT [heavy-haul truck] routes identified in the EIS, such as SR375 through Hancock Summit.

Response
DOE considers compliance with ANSI N14.27-1986 (DIRS 156289-ANSI 1987) to be only one element of effective emergency preparedness. There are many other elements of DOE's emergency preparedness program that help to ensure timely response to potential transportation accidents. The other elements include the accident response capabilities of DOE's eight Regional Coordinating Offices, preshipment planning, emergency response training for local first responders, satellite tracking and communications, driver training and awareness, and shipment prenotification. However, DOE is aware that risk minimization is best accomplished by preventing accidental releases in transit. The Type B accident-resistant packages that would be used to transport spent nuclear fuel and high-level radioactive waste are the key to prevention. However, should an accident occur, DOE, its contractors and carriers, and other Federal agencies would be prepared to respond. Section M.5 of the EIS provides more information about emergency preparedness for transportation accidents.

The EIS notes that the transportation carrier involved in an accident is responsible for planning, cost, and arrangements necessary to safely recover the shipment and clean up any radioactive contamination that occurred (see Section 6.2.4.2). Recovery of 23-metric-ton (25-ton) truck casks or rail casks weighing 110 metric tons (120 tons) is not an easy operation, especially in areas where deploying mobile carriers is difficult. However, capability to lift such weights does exist for rail and truck modes and would be deployed as required in the unlikely event of a cask leaving the conveyance or transport vehicle.

The Draft Request for Proposals for Waste Acceptance and Transportation Services (DIRS 153847-DOE 1998) describes Operational Protocols that the contractors would follow. These protocols are summarized in Section M.3 of the EIS. The Request for Proposals requires the transportation contractors to be responsible for providing DOE with specific written procedures that clearly define detailed actions to be taken in the event of an off-normal event. These procedures will address repair or replacement of equipment, or recovery, as appropriate. These requirements are applicable to transport by both truck and rail.

The EIS includes analyses of the public and worker health impacts of severe accidents that could result in failure of the shipping cask (see Sections 6.2.4.2 and 6.3.2). However, the specific locations of potential accidents cannot be predicted so bounding assumptions were made about the locations, such as conservative population distributions and weather conditions. An accident in difficult terrain, such as suggested by the commenter, would be unlikely to have greater health impacts than those analyzed in the EIS. This is because areas with difficult terrain would be sparsely populated in relation to the urban areas in which the maximum reasonably foreseeable accidents were assumed to occur.

8.10 (5713)
Comment - EIS001887 / 0326
Page 6-32 to 6-33; Section 6.2.4.2 .2– Impacts from Accidents – National Mostly Rail Scenario

The Draft EIS underestimates the radiological consequences of a maximum reasonably foreseeable rail accident by a least a factor 15, and by up to a factor of 40 or more. The number of latent cancer fatalities could be 1,380 or more.

Under contract with the State of Nevada, Radioactive Waste Management Associates (RWMA) prepared a bounding scenario analysis of the a accident reported in Table 6-12, using the RADTRAN and RISKIND models and a range of credible alternative assumptions about SNF [spent nuclear fuel] age and radiological characteristics, atmospheric dispersion, and population densities. Nevada is submitting the RWMA analysis as Attachment AA.

Response
The National Environmental Policy Act requires assessment of reasonably foreseeable impacts from proposed agency actions. In its various EISs, DOE has defined a reasonably foreseeable accident as one that has a frequency

of occurrence of at least once in 10 million years (1×10^{-7} per year). The concept of a maximum reasonably foreseeable accident is sometimes misinterpreted as being a "worst-case" accident. The analysis referred to by the commenter would be considered a worst-case analysis.

An example of a worst-case transportation accident would involve a shipment containing the highest possible quantity of spent nuclear fuel or high-level radioactive waste, in a highly populated area, with catastrophic failure of the shipping container, an engulfing fire lasting many hours, and stable weather conditions (very low atmospheric dispersion of plume). However, this worst-case accident scenario would not be reasonably foreseeable because it requires the simultaneous occurrence of a series of unlikely events, which, compounded, result in a likelihood of occurrence that is less than once in 10 million years. This is clearly the case with respect to the analysis referred to by the commenter, which assumed 10-year cooled spent nuclear fuel, the highest possible loading of crud on the external surfaces of fuel assemblies, population distribution equivalent to Manhattan, the highest possible release fractions, low wind speed, and stable atmospheric conditions. The analysis referred to by the commenter did not account for the probabilities of these conditions. The frequency of this specific accident scenario would be the combined frequency of any accident, the conditional probability of a severity category 6 event (as assumed by the commenter), and the probabilities of encountering the conditions discussed above (for example, low wind speed, 10-year cooled spent nuclear fuel, maximum crud source term). The frequency of this specific accident scenario would be well below the definition of maximum reasonably foreseeable. Council on Environmental Quality regulations (40 CFR 1502.22) state that analysis of accidents should avoid scenarios that are based on pure conjecture and avoid compounding conservatisms.

DOE is aware that there are uncertainties associated with the transportation impact results presented in the EIS. There are uncertainties associated with route characteristics, demographics, weather, atmospheric dispersion models, spent nuclear fuel characteristics, accident rates, release fractions, and many other elements of the risk assessments. Because one of DOE's goals is to choose between alternatives, the consistent consideration of uncertainty among alternatives means that the relative differences in impact estimates among alternatives should not be affected. To account for uncertainties in the data, conservative assumptions were made so the impacts reported in the EIS would bound the potential impacts (that is, would produce results that are higher than the true risk). However, DOE has chosen not to use conservative assumptions in all cases, as this practice tends to produce unrealistic and improbable results. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives. Thus, for example, DOE has chosen to use realistic waste characteristics information, accident rates, highway and rail distances between waste generators and the proposed repository, the number and distribution of people along the routes, and shipping cask capacities. DOE believes that the impacts presented in the EIS are bounding, yet not so conservative that the true differences among alternatives are masked. DOE does not believe it has understated the true risks of transporting spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository.

The analysis referred to by the commenter pointed out that the assumptions used in the EIS for the age and radiological characteristics of spent nuclear fuel in the maximum reasonably foreseeable accident scenarios could understate the transportation risks. It is true that DOE could ship some spent nuclear fuel that is more radioactive than the 26 year-old pressurized water reactor spent nuclear fuel analyzed in the scenario. Based on comments received and DOE's additional review of technical documents and conduct of hazard analyses, the basis for the transportation impact analysis has been revised to consider commercial spent nuclear fuel that has median hazard. Spent nuclear fuel having median hazard would be discharged from a reactor approximately 14 years before shipment to Yucca Mountain. If any 5-year old or 10-year old spent nuclear fuel were to be shipped to the repository, it would be a small fraction of the total shipments. This is a case in which "average" data is used in the EIS as opposed to bounding assumptions. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing accident scenarios. Other elements of the impact analyses (for example, radiation dose rates, atmospheric dispersion modeling, release fractions) are bounding such that the transportation impact results presented in the EIS are bounding.

8.10 (5731)
Comment - EIS001887 / 0339
Page 6-96; Section 6.3.3.1

Accidents

The Draft EIS discussion of HHT [heavy-haul truck] accidents is deficient. Because of the lack of actual experience with long distance HHT shipments, no meaningful empirical data is available to support the Draft EIS assertion that accident risks "are low for all five [route] alternatives."(p. 6-96) HHT operations on the routes identified in the Draft EIS may experience substantially higher accident frequencies and consequences. For example, using Nevada average accident rates and projected shipment-miles for DOE's Module 2 scenario, the expected number of HHT accidents on the Caliente route would be about 24 (12 loaded, 12 empty) over 39 years. The severity and consequences of accidents could be greater because of unique local hazards. Steep upgrades and downgrades (especially in combination with horizontal curves less than 800 feet radius) and critical side slopes and steep drop-offs (common near the summits of mountain passes) could subject casks to extreme accident impact forces and make emergency response, cask recovery, and post-accident cleanup difficult. Such conditions appear to exist near Oak Springs Summit on U.S. 93, near Hancock Summit on SR 375, and at several other locations along the Caliente HHT route.

Response
DOE recognizes the special considerations associated with heavy-haul truck shipments along the five candidate routes identified in the EIS. Road upgrades would be needed along these routes before their use to ship casks containing spent nuclear fuel and high-level radioactive waste. Tables J-36 through J-40 of the EIS summarize the road upgrades needed for the five routes. Heavy-haul truck shipments would be subject to permit conditions established by the State of Nevada, which would establish escort requirements and speed limit and other restrictions to reduce the risk of accidents associated with such shipments. Based on the restrictions placed on heavy-haul truck shipments, DOE believes that the use of Nevada average accident rates overestimates accident risks.

8.10 (5882)
Comment - EIS001900 / 0003
The DEIS does not examine the potential impact of transportation accidents in Connecticut or elsewhere. Yet, the Department of Energy has estimated that a severe accident in the transport of such waste would contaminate 42 square miles for well over one year. The State of Connecticut lacks an infrastructure to deal with such a disaster.

Response
In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist at al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10 (6233)
Comment - EIS001560 / 0005
One of which was the estimate of the chances of an accident being one to two in 10 million, I believe that's what was said. That sounds like a statistic and statistics are usually based on experience. Now does this mean that there have been one or two accidents already in 10 million tries, I doubt it. I think they have, somehow, come up with an estimate and made it sound like a valid statistic. Which concerns me greatly, especially because the difference between one and two in 10 million is a hundred percent difference in a statistic. So where is this estimate from?

Response
The EIS contains a discussion of potential impacts from accidents in both the mostly legal-weight truck scenario and the mostly rail scenario (see Section 6.2.4.2). The accident analysis included a description of the consequences of a severe accident that resulted in a leak in a transportation cask, although that is an extremely unlikely event [an

annual probability of 1.4 (rail) to 1.9 (truck) in 10 million]. A transportation cask could only leak if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. Section M.4 provides additional information on the safety and test of transportation casks. DOE believes the accident analyzed in the EIS covers accidents from all sources including heat, mechanical impacts, sabotage, impacts from airplanes and weapons, and mountain rollovers.

DOE, the U.S. Department of Transportation, and the Nuclear Regulatory Commission recognize that there are many uncertainties with rail or highway transportation. Many hazards exist—accidents, other drivers, weather problems, road or track problems—that could ultimately compromise safety. To mitigate the potential for a release of radioactive materials caused by these uncertainties, the Federal agencies listed above have a myriad of regulations, if adequately implemented, to preclude any release of radioactive materials. The Departments of Energy and Transportation and the Nuclear Regulatory Commission take human behavior seriously and consider this factor in all that they do, from selection and training of personnel to post transport evaluations (see Section J.1.4.2.1 of the EIS).

Factors that affect accident probability include state-specific accident rates; accidents per kilometer; the fraction of accidents that occur in rural, suburban, and urban population zones; the probability that an accident would be of a certain severity; and the annual shipping mileage in rural, suburban, and urban population zones. Weather conditions affect the probability of accident consequences because stable, worst-case, weather conditions are only about one-tenth as likely as neutral, average weather conditions.

8.10 (6332)
Comment - EIS001613 / 0002
I am not a scientist and I do not have enough information to completely dismiss the analysis and tests performed by the DOE to ensure the safe transportation of this hazardous material, but I do understand that these trucks will be driving through communities across America, and that one small release of radioactive material in a rural area would contaminate 42 square miles, require 460 days to clean and cost up to $620 million.

From your comments earlier tonight, I think we can all agree that human error is possible and, therefore, catastrophe could not be completely ruled out. I hope that your analysis is honest and not skewed to make it seem that the Department of Energy is taking responsibility for their actions.

On my way over here tonight, I was imagining the visual terror of thousands of trucks bearing the nuclear energy emblem driving through our communities as a reminder to our children that they will have to bear the burden of our actions.

Response
The EIS acknowledges that transportation accidents could occur during the transport of radioactive materials to the proposed Yucca Mountain Repository. In Section J.1.4.2.3.2, the EIS estimates that there could be as many as 66 accidents under the mostly legal-weight truck shipping scenario and 8 accidents could occur under the mostly rail scenario. A study recently conducted by the Nuclear Regulatory Commission (DIRS 152476-Sprung et al., 2000) concluded that only a tiny fraction of all accidents, less than one in 10,000, would be severe enough to result in a release of radioactivity from a spent nuclear fuel shipping cask. The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. Based on these statistics, DOE does not expect an accident to occur that would result in a radiological release and subsequent environmental cleanup.

Human error was considered in the EIS transportation analyses. For example, the truck and rail accident rates used in the EIS included accidents involving all causes, including those with human error as a cause. Human error in design, manufacturing, or use of transportation casks would be minimized through an aggressive quality assurance program and oversight by the Nuclear Regulatory Commission. Detailed written procedures would cover handling and loading of shipping casks at the commercial and DOE generator facilities and the proposed repository. Dry runs would familiarize operators with the shipping cask, cask handling equipment, and site-specific cask handling procedures. The transportation contractors, in addition to driver training and certification programs, would conduct detailed preshipment planning. All of these activities, and others, are designed to minimize the impacts of human errors. However, the greatest protection against human error during transportation would be the accident-resistant

Type B shipping casks used to transport spent nuclear fuel and high-level radioactive waste. A properly designed, fabricated, loaded, and maintained shipping cask would reduce vulnerabilities to all accidents, including human error, to levels that provided adequate protection to the public, workers, and environment.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10 (6476)
Comment - EIS001632 / 0033
Page 3-142, Sections 3.3.2 and 3.3.3: The draft EIS briefly discusses ground and surface water impacts, but we were unable to find an assessment of ground water contamination from a surface spill. The transportation impacts analysis should consider ground water recharge zones and the proximity of transportation corridors to ground water supplies and community water systems.

Response
The EIS sections cited by this comment identify potentially affected waterways and groundwater characteristics pertaining to the 77 commercial and DOE generator sites. Sections 7.2.1.3 and 7.2.2.3 discuss the potential hydrologic impacts associated with the No-Action scenarios.

With regard to transportation, Sections 3.2.2.1.3 and 3.2.2.2.3 of the EIS provides information on hydrology related to transportation corridors within Nevada. Table 3-37 and 3-39 present surface-water resources and groundwater basins, respectively, along the candidate rail corridors. Table 3-58 and 3-59 do the same for candidate heavy-haul truck routes. For Nevada transportation, potential impacts to hydrology from construction and operations are presented throughout Chapter 6. For example, see Section 6.3.2.2.1. The analyses are based on an identification of surface-water resources within the 400-meter (0.25-mile) corridor for each alternative and outside the corridor, but within 1 kilometer (0.6 mile). Designated groundwater basins are identified.

DOE does not specifically analyze a transportation accident, such as a spill, involving contamination of surface water or groundwater because the casks are designed to be watertight and spent nuclear fuel and high-level radioactive waste are not easily dispersed in water. While small particles could be generated by the impact forces of an accident, and driven out of a shipping cask by a severe fire, the amount of contamination that could ultimately enter groundwater would be much lower than that which would initially enter surface waters. Factors such as soil sorption of radionuclides, rate of flow into recharge areas, dilution by rain water and surface water, dilution by the large volume of groundwater, and delay associated with infiltration would mitigate and greatly reduce any contamination that could occur. Therefore, water pathway contamination, including subsequent contamination of food and natural resources, would not be a significant contributor to the radiological risks of transporting spent nuclear fuel. DOE has, however, identified potential mitigation measures for surface water and groundwater from the construction and operation of transportation systems. See Sections 9.3.3.1 and 9.3.3.2 of the EIS.

8.10 (6622)
Comment - EIS000938 / 0013
The analysis that was conducted to evaluate the dust cloud created by an accident is fatally flawed. Volume 2, Page J-8, 4th paragraph states that the average meteorological conditions are the national averages for wind speed and atmospheric stability. This assumption is assured for the State of California where North winds cause natural wind tunnels. An accident in one of the passes could spread the toxic dust cloud over the entire LA [Los Angeles] basin. DOE must utilize the wind and atmospheric conditions for the area being studied for the impact of a terrorist attack.

Response
The precise location, timing, prevailing weather conditions, and other circumstances surrounding a transportation accident cannot be predicted. In addition, it would not be practical for the EIS to attempt to analyze accident

consequences for every location along the shipping route. Instead, maximum consequences were analyzed for three types of population zones: urban, suburban, and rural. For example, an accident in the Las Vegas area would be characterized by the analysis for an urban area. In addition, the analysis of maximum reasonably foreseeable accidents considered conservative 95-percent meteorological conditions (conditions that are exceeded less than 5 percent of the time). These meteorological conditions result in larger impacts than the "average" conditions referred to by the commenter. Tables 6-14 and 6-15 of the EIS provide the estimated impacts of the maximum reasonably foreseeable accident in an urbanized area for truck and rail, respectively. Table J-24 shows consequences of maximum reasonably foreseeable accidents in urbanized and rural areas.

Section 6.2.4.2.3 of the EIS discusses potential sabotage. The use of average wind speeds and neutral atmospheric conditions does not greatly affect the estimated consequence of the event, should it occur. In fact, higher wind speeds and less stable atmospheric conditions would be expected to decrease the potential dose received by individuals in the path of any the release. The analyses in the EIS estimate as many as 48 latent cancer fatalities could result from a successful sabotage attack on a spent nuclear fuel shipping cask.

8.10 (6693)
Comment - EIS001632 / 0087
Page J-8, second full paragraph: This paragraph discussed the methodology used to estimate, the radiation impact resulting from accidents. The spectrum of possible accident severity was divided into categories. Then "each category of severity received a conditional probability of occurrence." A release fraction was assigned to each category. Please provide a brief discussion of how values were assigned and a table listing the values.

Response
Section J.1.4.2.1 of the EIS contains a discussion of accident severity categories, conditional probabilities, and release fractions. Figure J-9 shows the values for pressurized-water and boiling-water reactor spent nuclear fuel, respectively.

8.10 (6700)
Comment - EIS001878 / 0064
Incidents and accidents involving military aircraft and ground transportation have occurred in Nevada in the past, and may also occur in the future. The DEIS does not specifically evaluate this risk. The FEIS for Withdrawal of Public Lands for Range Safety and Public Purposes, NAS Fallon, NV (Department of the Navy, May 1998) and the FEIS, Proposed Fallon Range Training Complex Requirements, NAS Fallon, NV (Department of the Navy and Bureau of Land Management, January 2000) address the public safety impacts and other impacts of military aircraft operations in areas that would be affected by the transportation elements of the proposed action. However, the Yucca Mountain DEIS does not adequately consider: (1) potential cumulative public safety impacts, (2) whether the transportation elements of the proposed action would adversely affect the Navy's and the BLM's [Bureau of Land Management's] risk assessments, or (3) threats from military training flights associated with the Fallon NAS to trucks and trains carrying SNF [spent nuclear fuel] and HLW [high-level radioactive waste]. See Exhibit K for a map depicting current military flight patterns, which include many thousands of annual operations according to the Navy and the BLM.

Response
System malfunctions or material failures that could result in either an accidental release of ordnance or release of a practice weapon were discussed in the Renewal of the *Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement*, the *Final Environmental Impact Statement, Withdrawal of Public Lands for Range Safety and Training Purposes, Naval Air Station Fallon, Nevada*, and the *Final Environmental Impact Statement, Proposed Fallon Range Training Complex Requirements, Naval Air Station Fallon, Nevada*. The *Special Nevada Report* (DIRS 153277-SAIC 1991) states that the probability of dropped ordnance resulting in injury, death, or property damage ranges from about 1 in 1 billion to 1 in 1 trillion per dropped ordnance incident, with an average of about 1 in 10 billion per dropped ordnance incident. Less than one dropped ordnance incident is estimated per year for Nellis Air Force Range and Naval Air Station Fallon. Because the probability of such an accident is so low and, should an aircraft accident occur, the potential for release from such an accident is unlikely, no further analysis is presented in this EIS. In addition, considering the risk assessments presented in the Nellis Air Force Range, Naval Air Station Fallon, and this EIS, military training flights would not pose a safety threat to trucks or trains carrying

spent nuclear fuel or high-level radioactive waste nor a health risk to populations in the area. It is the Department's opinion that the EIS adequately analyzes impacts to transportation from military activities.

Bechtel-SAIC Company (DIRS 157210-BSC 2001) estimated the potential releases of radioactive materials that could result from the crash of a commercial jet airliner into a shipping cask containing spent nuclear fuel. According to the analysis, the release from a rail cask struck by a jet engine traveling 640 kilometers (400 miles) per hour and exposed to the ensuring jet-fuel fire would be no greater than the releases in a severe rail transportation accident in which the cask impacted a hard rock surface at between 48 and 97 kilometers (30 and 60 miles) per hour and was engulfed by fire for 0.5 hour. The consequences of this accident–1,300 person-rem or 0.67 latent cancer fatality–are presented in Section J.1.4.2 of the EIS. The consequences for an event in which the commercial airliner impacted a legal-weight truck cask would be about the same–1,100 person rem or 0.57 latent cancer fatality. A truck cask event that would have similar consequences would involve impact into a hard rock surface at a speed greater than 190 kilometers (120 miles) per hour followed by an engulfing fire for up to 0.5 hour.

8.10 (6769)
Comment - EIS001522 / 0010
It is even more question-begging, and even more incredible, when DOE knows neither the canister that will eventually be designed, nor the routes, nor the modes of transport, to claim that "the overall radiological accident risk ... from all accident scenarios over the 24 years of transportation activities ... would be about 0.07 latent cancer fatalities" at most (DEIS, 1999, 6-7). Obviously such fatalities depend strongly on the mode and routes of transport, so these figures appear to be mere guesses, and surely they are not science. Besides, as the state of Nevada pointed out, the DOE simplified cask design and accident scenarios, "created" data to fill the gaps, ignored human error in transport, and so on (DEIS, 1999, 6-29). Given all these problems with the DOE's using subjective data, there is no way that a reliable probability about cancer fatalities, induced by transport, could be given by the DOE. And if not, then the DEIS is not an example of science but an example of mere opinion, rhetoric, and begging the question.

Response
The transportation analysis in the EIS provides a reliable estimate of risks and impacts from shipments of spent nuclear fuel and high-level radioactive waste to the repository at a national level. At present, DOE cannot predict the actual mix of rail and legal-weight truck shipments that could occur. Therefore, the EIS analyzes two scenarios, mostly legal-weight truck and mostly train (rail), as bases for the transportation risk assessment. Using these scenarios, the analysis in the EIS describes the range of legal-weight truck and rail shipments that could occur. As a consequence, the transportation impacts that result from the actual mix of rail and legal-weight truck shipments when the repository was operational would be within the range of impacts estimated in the EIS.

The EIS contains a discussion of potential impacts from accidents in both the mostly legal-weight truck scenario and the mostly rail scenario (see Section 6.2.4.2 of the EIS). The accident analysis includes a description of the consequences of a severe accident that resulted in a leak in a transportation cask, although that is an extremely unlikely event [an annual probability of 1.4 (rail) to 1.9 (truck) in 10 million]. A transportation cask could only leak if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. Section M.4 provides additional information on the safety and test of transportation casks. DOE believes the accident analyzed in the EIS covers accidents from all sources including heat, mechanical impacts, sabotage, impacts from airplanes and weapons, and mountain rollovers.

DOE, the U.S. Department of Transportation, and the Nuclear Regulatory Commission recognize that there are many uncertainties with rail or highway transportation. Many hazards exist—accidents, other drivers, weather problems, road or track problems—that could ultimately compromise safety. To mitigate the potential for a release of radioactive materials caused by these uncertainties, the Federal agencies listed above have a myriad of regulations, if adequately implemented, to preclude any release of radioactive materials. The Departments of Energy and Transportation and the Nuclear Regulatory Commission take human behavior seriously and consider this factor in all that they do from selection and training of personnel to post-transport evaluations (see Section J.1.4.2.1 of the EIS).

The choice of canister type would not affect the transportation risk analysis because canistered and uncanistered fuel would be shipped inside Type B containers that met Nuclear Regulatory Commissions regulations for shipment of spent nuclear fuel and high-level radioactive waste.

DOE has not determined the specific routes it would use to ship spent nuclear fuel and high-level radioactive waste to the proposed repository. Nevertheless, the analysis in the EIS used current regulations governing highway shipments and historic rail industry practices to select existing highway and rail routes. This approach is consistent with previous DOE environmental impact statements that have evaluated national transportation impacts and provides a reasonable estimate of the potential environmental impacts of transportation of spent nuclear fuel and high-level radioactive waste to the proposed repository.

8.10 (6916)
Comment - EIS001784 / 0005
We need a lot more information on nuclear transport accidents that have occurred in the 2,500 "successful" shipments of similar high-level radioactive wastes that I have read have already taken place in the U.S. Where can I get this information? Will it be available to the public if the effort to upload Yucca Mountain with mega-rads goes into effect?

Response
The EIS does not refer to 2,500 successful shipments. It does use recognized analytical methods that incorporate accident experience data to estimate the likely impacts of the transportation of spent nuclear fuel and high-level radioactive waste. Besides the descriptions of transportation in this EIS (Chapter 6 and Appendix J), the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs: Final Environmental Impact Statement* (DIRS 101802-DOE 1995) contains more information. In addition, the *Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement* (DIRS 155100-DOE 1999) contains information on waste shipments.

The Yucca Mountain Project provides technical and project information on its Internet site (*http://www.ymp.gov*) and other media. The EIS contains revised information on the transportation of spent nuclear fuel and high-level radioactive waste.

8.10 (7083)
Comment - EIS001873 / 0032
P. 2-53. DEIS should state the maximum amount of radioactive waste that could be held at an intermodal facility and the maximum time that it could be held. These figures should be the basis for normal and accident scenario impacts including sabotage and terrorism. Security facilities connected with the intermodal sites should be identified.

Response
At this time, the heavy-haul truck alternatives for transporting spent nuclear fuel and high-level radioactive waste to the proposed repository are in conceptual stages of development. A concept for an intermodal transfer station is shown in Figure 2-28 and for a heavy-haul truck system is shown in Figure 2-29. A determination of the amount of the radioactive material and the amount of time a shipping cask would be held at the intermodal transfer station is unknown. However, if DOE decided to use heavy-haul truck transport and construct an intermodal transfer station within Nevada, it would conduct additional field surveys, state and local government consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews. The detailed information requested by the commenter would be developed as part of more detailed design and engineering studies, should DOE decide to use heavy-haul truck. In addition, detailed safety analyses of the intermodal transfer station would be conducted to evaluate more fully the final design and provide the basis for the identification of systems, structures, and components important to safety, technical specifications, safety-related controls, and safe operating procedures. For the purposes of the EIS, DOE believes it has adequately demonstrated the feasibility of the heavy-haul truck implementing alternatives, including the intermodal transfer station, and developed them sufficiently to support comparisons of alternatives and decisionmaking about transportation alternatives.

With respect to identification of security facilities, much of the security information about the intermodal transfer station would be protected as safeguards information. This would include such things as the designs and capabilities of physical protection systems, number and deployment of the protective force, locations and capabilities of intruder detection systems, etc. Information of this type is protected to prevent its disclosure to potential terrorists or saboteurs. As discussed above, additional engineering and design studies would be conducted, including development of physical security systems, if DOE decided to construct an intermodal transfer station.

8.10 (7099)
Comment - EIS000995 / 0011
During the Three Mile Island shipments, there was an accident on the very same, highly inspected and maintained train tracks, luckily not involving the TMI shipments. This accident sticks in my mind because it was in a very hard to reach area that was, also, close to highly populated communities. The accident involved train cars hanging, suspended, off of a train trestle over a river. For many hours they hung there while a high-intensity, long-duration fire blazed beneath them. It was a struggle for the emergency personnel to get to the accident site, severely delaying their response. What dangers would this type of accident present if the train cars were carrying the casks containing high-level radioactive waste from radioactive reactors nationwide?

Response
In the severe transportation accidents analyzed in the EIS, fully engulfing fires were analyzed. This means that the cask was assumed to be at the center of the fire, were the amount of heat transferred to the cask would be the greatest. At other locations, such as the cask dangling above the fire, the amount of heat transferred to the cask would be less and therefore, the amount of damage to the cask would also be less. Therefore, the consequences of the type of accident described by the commenter would be less than the consequences of the severe transportation accidents presented in the EIS.

The consequences of these severe accidents are presented in Sections 6.2.4.2.1 and 6.2.4.2.2 of the EIS for truck and rail transportation, respectively. For a severe truck accident, the probability is about 2.3 in 10 million per year. The consequences of this severe truck accident were estimated to be 0.55 latent cancer fatality. For a severe rail accident, the probability is about 2.8 in 10 million per year. The consequences of this severe rail accident were estimated to be 5 latent cancer fatalities.

8.10 (7265)
Comment - EIS001832 / 0013
DOE NEPA [National Environmental Policy Act] guidance to consider 1 in 10 million events is inconsistent with public policy elsewhere. Considering that used fuel will be transported for a relatively short period of time, the chances that such a "worst case accident" might occur is essentially zero. The chances of such a fatal accident are far less than those of loss of life due to meteor impact, which has a probability of occurrence of 1 in 100,000 years.* To find such an improbable accident to analyze, DOE had to go farther into the realm of the incredible than they will be required to do by the responsible regulatory authorities.** The extreme conservatism of going beyond what is reasonable, in postulating worst case accidents, forces DOE to consider severe transportation accident scenarios that are not credible thereby increasing the calculated environmental impacts and effects to non credible levels.

DOE's analysis of these highly improbable severe transportation accidents also assumes no mitigation, which is misleading. In reality, a swift and comprehensive emergency response would follow any severe transportation accident. While DOE must consider the full impacts of a postulated severe transportation accident, DOE should also include the results of mitigation measures related to emergency response.

If DOE believes it is required to leave analyses in the FEIS that consider 1 in 10 million events, the FEIS should, at a minimum, also describe the effects at higher, more realistic probabilities.

*United States Atomic Energy Commission, Reactor Safety Study, WASH-1400, August 1974

**For example, NRC [Nuclear Regulatory Commission] has proposed, in updating its Reactor Safety Goal Policy Statement, requiring licensees to evaluate large early release events having a probability of 1 in 10,000 or greater.

Response
The *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (DIRS 104601-DOE 1993) requires evaluation of high-consequence, low-probability accidents. This requirement is interpreted to mean accidents with at least a 1-in-10-million-per-year probability. These accidents are known as maximum reasonably foreseeable accidents. In order to provide an upper bound on potential consequences, DOE has chosen to not include the effects of mitigation, although interdiction of foodstuffs is assumed in evaluating the consequences of the maximum reasonably foreseeable accident. In the transportation risk assessment, a complete spectrum of accidents was evaluated, including accidents with higher probabilities than the maximum reasonably

foreseeable accident. The radiological risks from transportation accidents were found to be very low. The analysis of accidents for national transportation of spent nuclear fuel and high-level radioactive waste to a Yucca Mountain Repository is presented in Section 6.2.4.2 of the EIS.

8.10 (7273)
Comment - EIS001832 / 0021
Because the transportation of spent nuclear fuel is a subject of considerable public concern, DOE should put the transportation risk into perspective (as suggested in Comment I) with other non-voluntary risks that might be better understood by the general public. It should be evident, and clearly identified, that the risk associated with the transport of spent fuel as part of the proposed action is small. It may also be useful to put into perspective the less than 1 in 10 million probability of the severe transportation accident evaluated in the analysis (such as comparing it to the chance of a meteor striking a person.

Response
Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less.

8.10 (7383)
Comment - EIS001887 / 0325
Impacts of Maximum Reasonably Foreseeable Accident

The Draft EIS underestimates the consequences of a maximum reasonably foreseeable accident. The consequence assessment reported in Table 6-11 considered a cask loaded with 26 year-old PWR SNF [pressurized-water reactor spent nuclear fuel]. The Draft EIS should have evaluated a range of accident scenarios, including a cask loaded with 10 year-old PWR SNF and a range of other critical assumptions, including release height, atmospheric dispersion models, and downwind population densities. Nevada believes that RADTRAN and RISKIND analyses of the same accident involving 10 year-old fuel and other credible alternative assumptions would result in latent cancer fatalities higher by a factor of 2 to a factor of 40 or more, that is, 10 to 200 latent cancer fatalities.

Further, the NRC [Nuclear Regulatory Commission] recently authorized utilities to plan for truck shipments of 5 year Cooled, high enrichment (5 percent), high-burnup (62,000 MWR/MTHM) fuel to Yucca Mountain (Addendum 1 to NUREG-1437), and the discussion at page 6-12 indicates that DOE is not only aware of, but concurs in, the NRC assessment. Therefore, a legally sufficient evaluation of the maximum reasonably foreseeable accident should include a RADTRAN and RISKIND analysis of the same accident involving a GA 4 cask loaded with SNF having the same maximum radiological characteristics approved by the NRC. The human health effects of the same accident could be hundreds of times greater than those reported in Table 6-11.

Response
Based on comments the characteristics of the spent nuclear fuel used in the transportation analyses have been revised. As discussed in Section A.2.1.5 of the EIS, the revised spent nuclear fuel characteristics are

- Pressurized-water reactor -- 15 years old, 50 gigawatt-days per metric ton of heavy metal (MTHM) of burnup, 4.5 percent enrichment

- Boiling-water reactor -- 14 years old, 40 gigawatt-days per MTHM of burnup, 3.5 percent enrichment

These characteristics were derived through a dose-based hazard index analysis using the radionuclide inventory of the assemblies and the screening models in *Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground* (DIRS 101822-NCRP 1996). These screening models account for all exposure pathways.

The choice of these spent nuclear fuel assembly characteristics was based on a detailed hazards analysis that is discussed in Appendix A of the EIS. A spent nuclear fuel assembly with these characteristics has potentially higher accident consequences than more than 70 percent of the total number of spent nuclear fuel assemblies.

8.10 (7496)
Comment - EIS001576 / 0002
There is an analysis going on at the present time looking at interstates throughout the continental United States and looking at what kinds of obstacles are along the interstates. For instance, bridge abutments. On the interstate highway system a bridge abutment cannot be at 90 degrees from the roadway. It must be sloped away from the roadway and it must be tilted away from the roadway. So those kinds of things would cause glancing accidents, we've looked at those events but what is along that right of way that you could run into that might challenge the cask. So far and they haven't finished this, but they've done those stretches of roadway which were recommended as being the most likely to have these kinds of obstacles. They've come up to the conclusion that given what's alongside the highway that you could run in to, the cask would have to be traveling sideways, because it's got impact limiters on the end, which would abrogate the impact, but it had to be traveling sideways, at a speed of about 120 miles an hour in order to cause the cask to fail in some way. Not to break open, they're not egg shells, but to cause a leakage in some other part of the cask, usually the seals. I don't know about you, I've seen a lot of 18 wheelers going very fast, but I've never seen one going 120.

Response
DOE agrees that cask failure during a truck accident would be unlikely.

8.10 (7831)
Comment - EIS001595 / 0002
America's roads and rails are not reliable enough to bear this lethal load. We in Illinois remember the recent ghastly rail wreck in Bourbonnais where two steel cars compacted to a few feet thick.

Two weeks ago I was on I-80 going out to Omaha and it was littered with overturned semi's from an ice storm that had killed four professional drivers and scattered their loads onto the highway. The system proposed requires perfection and we do not have it. There is weather, there is human error and there is technical error.

Response
As discussed in Appendixes J and M, most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not likely result in release of radioactive materials from the shipping casks. The performance standards for the casks prescribed by the Nuclear Regulatory Commission ensure that less than 0.01 percent of real-world accidents would result in loss of cask integrity and release of radioactivity from the cask. These standards ensure that the casks would be extremely robust.

Adequate roads, highways, rail lines, crossings, bridges, and tunnels exist to support spent nuclear fuel and high-level radioactive waste transportation, which requires no special transportation infrastructure that is not necessary for the safe transportation of commodities in the United States.

As discussed in Section M.3.2.1.4 of the EIS, highway route determination would consider weather. The accident rates used in the EIS to analyze transportation impacts included accidents of all causes, including human errors and technical errors. More details on these accident rates are contained in Section J.1.4.2.3. Risks associated with transportation of radioactive material through Illinois are presented in Table J-82 of the EIS.

8.10 (7955)
Comment - EIS001903 / 0016
Pp. J-60 to J-63. The EIS should include a qualitative discussion of the nature of the maximum reasonably foreseeable accident scenarios. The EIS should also identify the composition and amount of material at risk (i.e., what kind of fuel and how much?) and what release fractions (from Table J-21 to Table J-22) were used.

Response
Section J.1.4.2 of the EIS has been revised to include a description of the maximum reasonably foreseeable accident. As in the U.S. Nuclear Regulatory Commission report *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000), the description is in terms of cask failure mechanism, impact velocity range, and temperature range for the accident. Other accidents are described in a similar manner in Section 7.2.6 of Sprung et al. (2000). Some of these accidents result in impact velocities and temperatures that exceed the U.S. Nuclear Regulatory Commission cask performance standards in 10 CFR Part 71.

The qualitative description of the accident has been expanded and clarified.

8.10 (7966)
Comment - EIS001791 / 0002
Where I live I've heard the train whistle. I know the patterns of the train whistles as they go past my house and there have been times in the recent past where those train whistles blow constantly and constantly, and I have run up to the track to see what was wrong. The signals are off and there's people crossing the tracks without knowing there's a train approaching, so that kind of potential is possible.

Response
The rail accident data used in the EIS included accidents of all causes, including grade crossing incidents, as discussed by the commenter. More details on the rail accident data are provided in Section J.1.4.2.3 of the EIS.

8.10 (8050)
Comment - EIS002001 / 0003
What will happen to us if a truck gets into a wreck and an explosion occurs? Think of the people in it will hurt or even kill.

Response
The EIS acknowledges that transportation accidents could occur during the transport of radioactive materials to the proposed Yucca Mountain Repository. In Section J.1.4.2.3.2, the EIS estimates that there could be as many as 66 accidents under the mostly legal-weight truck shipping scenario and 8 accidents could occur under the mostly rail scenario. A study recently conducted by the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000) concluded that only a tiny fraction of all accidents, less than one in 10,000, would be severe enough to result in a release from a spent nuclear fuel shipping cask. The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. Based on these statistics, DOE does not expect an accident to occur that would result in a radiological release and subsequent environmental cleanup.

Although it is extremely unlikely that an accident would occur resulting in functional damage to the cask and a release of radioactivity, the EIS evaluates the consequences of such an accident if it occurred. For example, Table 6-14 provides the estimated impacts of the maximum reasonably foreseeable accident for truck transportation. The highest consequences would occur in an urbanized area resulting in about 0.55 latent cancer fatality. The likelihood of such an accident is very small, about 2.3 in 10 million years. Table 6-15 presents this same data for the mostly rail scenario. The maximum reasonably foreseeable accident for rail transportation would occur in an urbanized area resulting in about 5 latent cancer fatalities. Similar to the truck accident, the likelihood of such a rail accident is very small, about 2.8 in 10 million years.

8.10 (8109)
Comment - EIS001873 / 0006
One worst-case accident scenario for a transportation accident involving highly radioactive waste indicates a 40-square mile area would be contaminated. Nuclear waste accidents have a potential for extremely bad consequences, which must be weighed against their probability of occurrence. In Caliente, the probability of occurrence would appear to be much higher if a transfer depot were located near the city than if train shipments were just passing through.

Response
The EIS acknowledges that transportation accidents could occur during the transport of radioactive materials to the proposed Yucca Mountain repository. In Section J.1.4.2.3.2, the EIS estimates that there could be as many as 40 accidents under the mostly legal-weight truck shipping scenario and 2 accidents could occur under the mostly rail scenario. A study recently conducted by the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000) concluded that only a tiny fraction of all accidents, less than one in 10,000, would be severe enough to fail a spent nuclear fuel shipping cask. The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. Based on these statistics, DOE does not expect an accident to occur that would result in a radiological release and subsequent environmental cleanup.

However, in response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

Potential accidents at an intermodal transfer station were analyzed in Section J.3.3.1. Because the spent nuclear fuel and high-level radioactive waste would remain within the sealed transportation casks while at the intermodal transfer station, they are not very vulnerable to release from the casks. This analysis found no credible accidents with the potential for release of radioactive materials from the transportation casks being handled at the facility.

8.10 (8154)
Comment - EIS001653 / 0093
Pg 6-41 Maximum Accident-should be based upon shipment miles.

Response
DOE based the probabilities, or frequencies, of the maximum reasonably foreseeable accidents calculated in the EIS on the total shipment miles, as suggested by this comment. With the exception of Nevada, which would host the proposed repository, DOE chose to describe transportation impacts on a national rather than a regional level. The EIS indicates that because transportation impacts on the national level would be low, impacts for individual regions would be lower.

8.10 (8255)
Comment - EIS000817 / 0100
P. 4-59. No matter how you look at it, hauling waste across the country and storing it at Nevada has to bring an increase to cancer and radiation doses. Why risk this? Too many accidents are possible. Some will happen. Human error will be a big concern. This is not a perfect world.

Response
Transporting spent nuclear fuel and high-level radioactive waste across the country could result in a slight increase in radiation doses and cancer rates for people along the transport routes. In Section 6.2.3 of the EIS, DOE has estimated that there could be up to 1.6 to 2.5 latent cancer fatalities from the routine shipping of spent nuclear fuel and high-level radioactive waste by legal-weight trucks and by rail. Transportation accidents, including those caused by human error, were examined in the EIS. In Section 6.2.4, DOE estimated that there is a 2.3 in 10 million probability per year of a maximum foreseeable truck accident. Should the accident occur, there could be about 0.55 latent cancer fatality in the exposed population. For perspective, there would be about 220,000 cancer fatalities in a population on 1 million along the transport routes from other causes besides the transport of spent nuclear fuel and high-level radioactive waste.

8.10 (8291)
Comment - EIS001575 / 0001
As we try to do this plan of taking nuclear waste and moving it all across the country, it's like a standardized McDonald operation, every truck will be the same, every driver will be the same, I'm sure there won't be any variables. Well, I just wrote down a few variables. Who makes the trucks? Are they always exactly the same?

60 minutes or 20/20 just had a program that said about licensing of drivers. It said that they have no information about drivers, they don't have anything about their records, they don't have anything about their mental states, there's 10,000 variables. We see bus drivers go off the road because they have a heart condition. We see two basketball players going 100 miles an hour and one of them doesn't even have a license and one of them does. There's so many variables in this thing. What happens if weather comes, black ice? What if two kids in Lakewood, playing around with a crowbar on one of those rail tracks decide just to move one a little bit? It's just a little bit of vandalism, it isn't gonna matter at all. Poor people here in Lakewood, they thought they had it so well because Mayor White is going to eliminate the sirens through their town. It's going to be awful quiet as it goes through Lakewood in a tough density place with nuclear waste going through there. So then once the sirens are quiet, who knows what can happen.

Response
As stated in Section 2.1.3.2 of the EIS, DOE would comply with all applicable regulations of the U.S. Department of Transportation and the Nuclear Regulatory Commission. At this time, many years before shipments could begin, DOE does not know who would make the trucks used to transport spent nuclear fuel. However, all trucks would have to pass the Commercial Vehicle Safety Alliance enhanced safety inspection, which includes a radiological survey and stringent examination of all driver, vehicle, and hazardous material requirements. DOE knows how it would acquire Regional Servicing Contractors, and the protocols and processes to which these contractors would be held (see Section M.3). These protocols are based on Department of Transportation and Nuclear Regulatory Commission regulations and the successful experience achieved during the Waste Isolation Pilot Plant transportation activities.

The accident analysis includes a description of the consequences of a severe accident that would result in a leak in a transportation cask, although that is an extremely unlikely event [an annual probability of 1.4 (rail) to 1.9 (truck) in 10 million]. Transportation safety related to potential release of radioactive materials is primarily based on the integrity of shipping cask. The leaking of a transportation cask could only occur if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. Additional information on the safety and test of transportation casks is provided in Section M.4 of the EIS. The accident analyzed in the EIS is believed to cover accidents from all sources including heat, mechanical impacts, sabotage, impacts from airplanes and weapons, and mountain rollovers.

Truck drivers would have to meet physical standards, have a commercial driver's license, and successfully complete a road test. Drivers would be trained on the properties and hazards of spent nuclear fuel and high-level radioactive waste as well as on the procedures to follow in the event of an emergency. Drivers would also have training in the use of radiation detection instruments, use of communications and satellite tracking equipment, inspection procedures, and adverse weather procedures. The Nuclear Regulatory Commission regulations also address human behavior as discussed in Section J.1.4.2.1 of the EIS.

8.10 (8321)
Comment - EIS001963 / 0003
The DEIS should clearly and accurately explain the risks involved along the transportation routes. It should also use the most current information to do so. It should also include site-specific data to show the effects of accidents in populated areas.

Response
DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site is approved. The reader is referred to the introduction to Chapter 8 of the CRD for additional information.

At this time, many years before shipments could begin, it is impossible to predict with a reasonable degree of accuracy which highway or rail lines would be used. For example, in the interim, state or Native American tribal governments may designate alternate preferred highway routes and new highways and rail lines could be constructed or modified. Therefore, for purposes of analysis in the EIS, DOE identified representative highway routes in accordance with U.S. Department of Transportation regulations, which require the use of preferred routes (Interstate System highway, beltway or bypass, and state or tribal designated alternate route). DOE identified rail lines based on current rail practices, as there are no comparable Federal regulations applicable to the selection of rail lines for the shipment of radioactive materials. In response to public comments, DOE has included in the EIS maps of representative highway routes and rail lines that were used for the EIS analysis (see Figures 6-11 and 6-12).

The analysis is route-specific to the extent needed to support the decisions to be made on the basis of the information contained in this EIS. For example, the analysis considered route-specific shipping distances and population data as well as state-specific truck accident rates. The most recent publicly available data was used in the analysis. The use of additional location-specific data such as the commenter suggests would not materially affect the comparisons of alternatives and decisions to be made with regard to construction and operation of the proposed repository. The requested analysis could provide useful information for identifying and quantifying differences between alternative routes; however, DOE does not intend to designate preferred routes based on the EIS. Rather, this would occur in the future, and would be conducted in accordance with U.S. Department of Transportation routing guidelines. The preferred routes would be submitted to the Nuclear Regulatory Commission for approval. DOE would consider location-specific data during the route selection process.

8.10 (8325)
Comment - EIS001572 / 0002
Living close beside an interstate in Toledo on the emergency vehicle entry route, I've noticed an increasing frequency of accidents on that interstate. I suggest a review of the -- and greater definition of the projections of future accident frequencies going into the calculation.

Response
Recent state-specific accident rates were used in the accident analyses for the EIS. In addition, accident rates were one of the primary route selection factors identified in the U.S. Department of Transportation report *Identification of Factors for Selecting Modes and Routes for Shipping High-Level Radioactive Waste and Spent Nuclear Fuel* (DIRS 103718-DOT 1998).

8.10 (8383)
Comment - EIS001873 / 0066
P. 6-96. Accident risks are not the same for the different routes, which should be obvious. Accident risks should be higher in the intermodal transfer area.

Response
The comment correctly points out that a statement in Section 6.3.3.1 of the Draft EIS that "…accident risks … would be the same among the Nevada heavy-haul truck transportation implementing alternatives…" is incorrect and not consistent with the data listed in Table 6-55. DOE has corrected this in the Final EIS.

There are no data to support the statement that "Accident risks should be higher in the intermodal transfer area." Accident risks, however, would be proportional to the number of operations and shipment miles.

8.10 (8414)
Comment - EIS001873 / 0077
P. 9-17. Having identified the potential for contamination of surface water, DOE must explain how they would clean up the Meadow Valley Wash after a worst case accident near the Caliente intermodal site and what that would cost.

Response
An accident that resulted in contamination of the Meadow Valley Wash near the Caliente intermodal site would be extremely unlikely. Spent nuclear fuel and high-level radioactive waste would be transported in very robust casks, designed to withstand the impact forces and fires that could be associated with very unlikely transportation

accidents. The forces associated with handling accidents at the intermodal site would be far less severe than the design and performance standards for the casks. Potential accidents at an intermodal transfer station are evaluated in Section J.3.3.1 of the EIS. No credible scenarios were identified that would likely result in a release from the casks.

Environmental Impact Statements are not required to analyze "worst-case" accidents. Rather, EISs analyze those accidents that are reasonably foreseeable. According to Section 6.4 of *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (DIRS 104601-DOE 1993), these are accidents with probabilities in the range of 1 in a million to 1 in 10 million per year. The consequences of severe accidents are presented in Sections 6.2.4.2.1 and 6.2.4.2.2 of the EIS. For the maximum reasonably foreseeable truck accident, the probability would be about 2.3 in 10 million per year, and for a maximum reasonably foreseeable rail accident, the probability would be about 2.8 in 10 million per year. A transportation accident near Meadow Valley Wash, such as the maximum reasonably foreseeable accident accidents analyzed in Chapter 6, would not be reasonably foreseeable because its probability would be less than 1 in 10 million per year.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10 (8420)
Comment - EIS001887 / 0435
Use of data from the Modal Study to estimate accident severities and probabilities of severe accidents

1.1. Use of "mid-lead" temperature as parameter determining accident severity

1.1.1 Lead (MP 621 degrees F) will stabilize the inner core temperature in the event of a fire until it is completely melted. This has the affect of insulating the inner core from temperature increases for an extended period of time. Uranium, with a much higher melting point, will not melt, resulting in an inner core temperature that will rise constantly with heat input; therefore, inner cores of newer casks are expected to have higher temperatures during a fire of a given intensity.

1.1.2. The use of mid-lead temperature results in grouping of all fires with temperature greater than 1050 degrees F into one consequence category, since lead-nickel alloying occurs here, weakening the integrity of the older casks. Since uranium and/or stainless steel will behave differently under temperature duress, new classifications based on its properties must be used for categorizing fire intensities.

1.2. Use of "reference cask" containing a water jacket neutron shield

The Modal Study models the dead air space resulting from the evaporation of the water jacket neutron shield to reduce the heat transfer rate from a fire to the cask by over 70%. Modern casks use polypropylene, not water jackets; hence the estimated heat transfer rate in fire events is a significant underestimate of the behavior or modern casks (Audin states this may result in a reduction in the time it takes to melt the lead cask from 1.09 hours to 20 minutes).

1.3. "Lead cask bias" used to select most appropriate measurement parameter

The decision to use strain on the inner cask wall as the primary measure of cask response is based on lead's tendency to "slump" when subjected to high loading, resulting in high strains on inner cask wall. However, uranium and/or stainless steel, is strong and rigid and thus will not slump. Rather, the force from impacts will be transferred to the joints and welds of the cask, likely resulting in a greater force being applied to them that those in a lead cask. The choice of strain as the sole measurement parameter for physical duress will likely lead to an underestimation of

the damage caused to newer casks through picture of welds and seals in the event of an accident. Therefore, new experiments must be performed to model this behavior.

1.4. Incorrect use of "distribution" and "frequency" of velocities

The EIS states that, even though the average speed limit on national interstates has increased since the Modal Study, the distribution of accidents, and the frequency distribution of accidents, on the highways is not likely to change. However, no evidence is cited to support this statement. The National Highway Safety Traffic Administration (NHTSA 1998), along with numerous other agencies, have provided evidence that increases in speed limit lead to more accidents, more fatalities, and a greater proportion vehicles traveling at higher speeds. All of these suggest that the DOE is incorrect in claiming that increased speed limits will not affect accident severity distributions. In one study assessing the change in Interstate fatalities in states which raised the speed limit in 1995, the NHSTA discovered that "Interstate fatalities experienced a statistically significant increase in those states that raised their posted speed limits late in 1995 or early in 1996." (NHTSA 1998) Further, the Insurance Institute for Highway Safety reported that distributions of travel velocities do indeed change with increased speed limits. For example, the Institute cited traffic statistics in New Mexico, finding that "the proportion of motorists exceeding 70 mph grew from 5 percent shortly after speed limits were raised [from 55 to 65 mph] to 36 percent." (Institute). This shows that the EIS's statement that traffic velocity distributions will not be affected is incorrect, which leads to the conclusion that the probabilities of severe accidents used by the EIS are also incorrect and likely to be underestimates. This provides another reason why the Modal Study is not useful or relevant to current transportation conditions.

1.5. Improper assumptions regarding the location of severe accidents

The Modal Study correlated severe accidents with high velocities, concluding that the most severe accidents will take place, both for rail and truck, in rural environments. However, most severe rail accidents take place at downgrades, which are as likely to be located in suburban areas as rural ones. Further, the probability of a severe truck fire is greater in urban and suburban environments then it is in rural ones. Refer to Resnikoff, 1993.

In determining severe accident scenarios, the EIS assumed that severe accidents had an equal probability of occurring anywhere, with the probability in each population zone being determined by the length of time each truck or train passes through it. Since trucks and trains spend less time in urban zones, some of the most severe accident scenarios are considered "not reasonably foreseeable" in urban areas. Accident data does not support the assumption that severe accidents are randomly distributed (Resnikoff, 1993). Therefore, the DOE needs to assess the consequences of these most severe accidents as occurring in urban zones.

1.6. Improper Exclusion of most severe accident scenarios

1.6.1. The Modal Study used as its "average highway conditions" a stretch of Interstate 5 in Los Angeles and Orange counties. For example, it tallied the number, height, and geographic conditions of the bridges on this stretch and used these to estimate the number of bridges of a certain height. This was then used to estimate how many tall bridges existed in the entire nation for spent fuel trucks to cross. Using this, it was determined that an accident involving a truck falling off a high bridge was not "reasonably foreseeable" and its consequences were not determined. Since this stretch of highway is dominated by urban areas, the distribution of bridge types is biased in favor of small, short bridges, like the ones that cross over other roads. This is not representative of national conditions and leads to the unnecessary exclusion of a potentially disastrous consequence.

1.6.2. The Modal Study assumes that the probability of train accidents involving the falling off of a bridge is the same as that for the highway scenario, with the geographic conditions also taken from the highway estimations. More clearly, the Study used data taken from Interstate 5 to estimate the geographic conditions of national train routes, including bridge heights. Thus, the same argument given for the highway scenario (point 1.5.1) holds here, but more so since there is no proof that highway and rail conditions are similar.

1.6.3. The method of rejecting accidents having a yearly probability less than one in 10 million is arbitrary and incorrect when performing a probabilistic risk assessment. The product of the probability and the likely consequences are what determine significance in a risk assessment.

1.6.4. DOE consistently offers estimations of health effects due to transportation without giving a range of likely effects in the event of an accident. This is based on the assumption that the effects given are "conservative." However, the points raised here show that the studies are not conservative: unless new studies are performed, a range of possible health effects should be given.

1.6.5. If the DOE insist on using the "reasonably foreseeable" criteria of 1 in 10 million mentioned above, improper accident distribution data, unknown cask response to accident conditions, and improper estimation of accident probabilities (all mentioned above) will make some circumstances not deemed "reasonably foreseeable" in the Modal Study "reasonably foreseeable." These events must be considered in any acceptable consequence analysis.

Response

General: At the time the Draft EIS was published, DOE considered *Shipping Container Response to Severe Highway and Railway Accident Conditions* (DIRS 101828-Fischer et al. 1987; also called the Modal Study) to contain the best available information regarding spent nuclear fuel shipping cask performance under severe accident conditions. However, the Nuclear Regulatory Commission recently published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 154276-Sprung et al. 2000), which contains additional information regarding spent nuclear fuel transportation accidents, including the use of different shipping cask designs than the representative steel-lead-steel cask used in Fischer et al. (DIRS 101828-1987). This study addresses, in part, the criticisms of the Modal Study that are summarized by the commenter. Because Sprung et al. (2000) provides more recent information and is based on the most recent shipping cask designs (including steel/lead/steel, steel/depleted uranium/steel, and solid monolithic steel designs), DOE has conducted an analysis using the information from Sprung et al. (2000). The results of this analysis are presented in Appendix J of the EIS and show that the impacts estimated in the EIS using Fischer et al. (1987) exceed the impacts estimated using Sprung et al. (2000). As a consequence, the Draft EIS overestimated the impacts of spent nuclear fuel transportation accidents and the Final EIS contains more realistic estimates.

Comments 1.1.1 and 1.1.2. These comments have been addressed by Sprung et al. (DIRS 152476-2000), which considers the performance of depleted uranium shielded and monolithic steel shipping cask designs subjected to severe fire conditions.

Comment 1.2. This comment, which is about the neutron shield material assumptions in the thermal analysis, is addressed specifically in Sprung et al. (DIRS 152476-2000). Section 6.5 of that document states that the neutron shield region was set to change instantaneously at the start of the fire from water to air in the transient thermal analysis. This causes the inner surface of the neutron shield to reach fire temperature very rapidly. If water or solid hydrogenous materials were present in the neutron shield region, it would absorb thermal energy and slow the heatup of the inner regions of the shipping cask. Thus, the assumption of an air-filled neutron shield region is conservative in relation to assuming water or solid hydrogenous materials are present in this region.

Comment 1.3. This comment has been addressed by Sprung et al. (DIRS 152476-2000), which considers the performance of depleted uranium shielded and solid monolithic steel shipping cask designs subjected to severe impact conditions.

Comment 1.4. DOE was unable to identify recent studies that could be used to quantify the effects of increased Interstate System highway speeds on traffic accident rates or severities. However, on a national basis, the fatality rate in 1999 for all motor vehicle accidents remained at historically low levels, the same as 1997 and 1998 fatality rates, and lower than the rates from 1989 to 1996. Fatality rates in 1999 were lower for all vehicles and for large trucks than they were in the early 1990s, before the Interstate Highway System speed limits were increased. This information was obtained from BTS (DIRS 148081-1999). Although there are other factors that contribute to the trends in fatality rates, such as increased use of seat belts, increased legal drinking age, and reduced blood alcohol content restrictions, the increased Interstate System highway speed limits have not had a dramatic effect on national fatality rates for all vehicles or for large trucks alone. In addition, a significant change in highway fatality rates could affect the magnitude of the impacts calculated but would not have a significant effect on the comparisons among alternatives or on identification of the preferred national or Nevada transportation alternatives.

The Nuclear Regulatory Commission is currently designing a program to further evaluate spent nuclear fuel shipping cask integrity in the "Package Performance Study." The planned study, which is scheduled for completion in 2004, will provide an updated evaluation of the level of safety provided by spent nuclear fuel transport packages under a variety of railway and highway accident conditions.

Comment 1.5. The analysis of the likelihood and consequences of maximum reasonably foreseeable accidents is presented in Section J.1.4.2.1 of the EIS. The National Environmental Policy Act requires assessment of reasonably foreseeable impacts from proposed agency actions. In its various EISs, DOE has defined a reasonably foreseeable accident as one that has a frequency of occurrence of at least once in 10 million years (1×10^{-7} per year). The concept of a maximum reasonable foreseeable accident is sometimes misinterpreted as being a "worst-case" accident. A worst-case accident would be one in which conservative assumptions were used to maximize the consequences, such as worst-case weather, 100-percent release of shipping cask contents, highest population density, etc. Such "compounded" conservatisms yield unrealistic results for an accident scenario that is not credible. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives. DOE believes that the impacts presented in the EIS are bounding, yet not so conservative that the true differences among alternatives are masked.

The commenter is incorrect in asserting that the EIS did not evaluate the consequences of maximum reasonably foreseeable accidents in urban areas. In Section J.1.4.2.1 of the EIS, the consequences of maximum reasonably foreseeable accidents are listed for both urban and rural areas.

Comment 1.6.1. This comment, which is about the "average highway conditions" along potential spent nuclear fuel shipping routes, has been largely resolved by incorporating the Sprung et al. (DIRS 152476-2000) accident model into the transportation impact analysis. The analysts evaluated shipping cask performance under 190-kilometer (120-mile)-per-hour impact conditions onto an unyielding surface. A shipping cask would need to free-fall a great distance to strike a surface at 190 kilometers (120 miles) per hour. Finite element analyses of the truck cask designs did not predict with certainty that a 190-kilometer impact onto an unyielding surface would produce seal leakage. For rail cask designs, Sprung et al. (2000) predicted seal leakage to occur for 97-kilometer (60-mile)-per-hour impact events onto unyielding surfaces, equivalent to a freefall from about 37 meters (120 feet). When "real-world" surfaces are assumed, the impact velocities (and thus the approximate freefall distances) that are required to cause cask seal leakage increase substantially. For this reason, the probability that such impact velocities are achieved is extremely small leading to the conclusion that the occurrence of such an accident is not reasonably foreseeable.

Comment 1.6.2. This comment is similar to 1.6.1 above except it addresses rail casks falling from high bridges. The same response applies.

Comment 1.6.3. The National Environmental Policy Act requires assessment of reasonably foreseeable impacts from proposed agency actions. In its various EISs, DOE has defined a reasonably foreseeable accident as one that has a frequency of occurrence of at least once in 10 million years (1×10^{-7} per year).

Consistent with the National Environmental Policy Act and DOE practice, the EIS conducts two analyses of transportation accident impacts, the maximum reasonably foreseeable accident assessment and the probabilistic risk assessment. The probabilistic risk assessment, conducted using the RADTRAN 5 computer code, considers the entire spectrum of accidents, including those worst-case accidents that are less likely than once in 10 million years. The computer code evaluates the probabilities of accidents and their consequences, combines the probability and consequence information to calculate risk values, and then sums the risk values across the entire spectrum. In the probabilistic risk assessment, the once-per-10-million-year frequency criterion is not employed to truncate the analysis, as the commenter suggests. However, it is true that the extremely unlikely accident scenarios (that is, those with frequencies less than once per 10 million years, do not contribute significantly to the total integrated risk. Although the consequences of these extremely unlikely accidents would be large, their frequencies would be so small that their risk values, which are the products of their frequencies and consequences, would be small in relation to the risk of more frequent but less severe accidents.

The probabilistic risk assessment is different than the maximum reasonably foreseeable accident analysis. In the analysis of the consequences of the maximum reasonably foreseeable accident, the results are presented in terms of the maximum consequences to the population and maximally exposed individual potentially affected by the accident. Only the consequences of such accidents are presented; that is, the combining of the frequency and consequence terms to develop a risk value is not performed in the maximum reasonably foreseeable accident analysis.

In the analysis of the maximum reasonably foreseeable accident, the EIS considered accident scenarios with frequencies less than once per 10 million years. These accidents are not reasonably foreseeable, but the consequences of these accidents are listed in Tables J-22 and J-23 of the EIS.

Comment 1.6.4. DOE is aware that there are uncertainties associated with the transportation impact results presented in the EIS. There are uncertainties associated with route characteristics, demographics, weather, atmospheric dispersion models, spent nuclear fuel characteristics, accident rates, release fractions, and many other elements of the risk assessments. Because one of DOE's goals is to choose between alternatives, the consistent consideration of uncertainty among alternatives means that the relative differences in impact estimates among alternatives should not be affected. To account for uncertainties in the data, conservative assumptions were made so the impacts reported in the EIS would bound the potential impacts; would produce results that are higher than the true risk. However, DOE has chosen not to use conservative assumptions in all cases, as this practice tends to produce unrealistic and improbable results. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives. Similarly, presenting ranges of impacts, as the commenter suggests, would also mask the true differences between alternatives. It would provide misleading information and lend credibility to accident scenarios that are clearly insignificant contributors to the true risks of transporting spent nuclear fuel and high-level to the proposed repository. Presentation of ranges of impacts would require complex and confusing explanations of how the ranges were calculated and their significance. This would be contrary to one purpose of an EIS, which is to provide clear and concise information to the public about the environmental impacts of proposed agency actions. Therefore, the EIS concentrates on developing point estimates with approximately equal levels of conservatism and uncertainty so valid comparisons among alternatives can be made.

Comment 1.6.5. The transportation impact analysis in the EIS, including the analysis of maximum reasonably foreseeable accidents, is consistent with National Environmental Policy Act requirements, Council on Environmental Quality Guidelines, and DOE policies and procedures. The analysis of reasonably foreseeable accidents is based on the best data available to DOE, considers the designs of current generation shipping casks, uses appropriate accident probability distributions and estimation techniques, and is more comprehensive in scope and level of detail than the transportation impact analyses in most other EISs prepared by Federal agencies. The analysis in the EIS has been revised to reflect the recently published reanalysis of spent nuclear fuel shipment risks (see DIRS 152476-Sprung et al. 2000), which updates the accident risk model developed in Fischer et al. (DIRS 101828-2000). The methods used to calculate transportation impacts are state-of-the-art. As a consequence, DOE believes the scope, level of detail, and basis for the transportation impact analysis are consistent with all National Environmental Policy Act-related requirments and that the EIS adequately analyzes potential impacts of the Proposed Action and certain aspects of transportation.

8.10 (8460)
Comment - EIS000306 / 0006
Your estimates do not suggest the temperature that a diesel fire causes, and it would burn more than the half hour that you suggest.

Response
As discussed in Appendixes J and M, most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not likely result in release of radioactive materials from the shipping casks. The performance standards for the casks prescribed by the Nuclear Regulatory Commission were selected to ensure that less than one percent of real-world accidents would result in loss of cask integrity and release of radioactivity from the cask. These standards ensure that the casks would be extremely robust.

As stated in Section J.1.4.2.1 of the EIS, the temperature of the fully engulfing fire was assumed to range from 750ºC (1,350ºF) to 1,000ºC (1,800ºF). Truck fires were assumed to burn for up to 8 hours and train fires were assumed to burn for up to 11 hours. More details on fire duration and temperature can be found in the Nuclear Regulatory Commission study *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000).

8.10 (8471)
Comment - EIS000817 / 0143
P. 6-29. You are basing some of this on a 1987 study by Fischer. That is just too outdated. The Nuclear Waste Project comments are valid. It's not up to them to do your studies for you, only to comment on what you do. There should be tests to benchmark computer models. All too often this is not done correctly.

Response
The EIS has been revised to use the release fractions and conditional probabilities from *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Benchmarking of the finite element code used in the analysis is discussed in Section 5.1.5 of that study. The changes from using the data from Sprung et al. (2000) are that radiation risk for rail and truck accidents are lower, radiation impacts for incident-free truck transportation are lower, and consequences of severe accidents are higher. These results are included in Chapter 6 of the EIS.

8.10 (8607)
Comment - EIS001837 / 0009
What if the narrow railroad bridge across the Colorado River adjacent to the Federal Wildlife Preserve, collapses under the weight of the heavy high level nuclear waste shipments? Your DEIS is inadequate and deficient because it does not address the issue of reinforcing that bridge or cleaning up potential spills into the Colorado River, or how to prevent attacks on that bridge. What is the contingency plan if the train derails on the bridge or the casks fall into the Colorado River and destroys the drinking water of millions of people?

Response
Adequate national highways, rail lines, crossings, bridges, and tunnels exist to support the transportation of materials described in the EIS. The shipment of radioactive materials requires no special transportation infrastructure that is not necessary for safe transport of commodities in the United States today. The U.S. Department of Transportation is the regulatory agency responsible for establishing and enforcing the standards for the transportation infrastructure.

The precise location, timing, prevailing weather conditions, and other circumstances surrounding a transportation accident cannot be predicted. In addition, it would not be practical for the EIS to attempt to analyze accident consequences for every location along the shipping route. Instead, maximum consequences are analyzed for three types of population zones: urban, suburban, and rural. For example, an accident in the Las Vegas area would be characterized by the analysis for an urban area. Table J-24 shows consequences of maximum reasonably foreseeable truck and rail accidents in urbanized and rural areas.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

The EIS does not specifically analyze a transportation accident involving contamination of surface water or groundwater. Analyses performed in previous EISs (see Section 1.5.3 and Table 1-1 of this EIS) have consistently shown that the airborne pathway has the greatest potential for exposing large numbers of people to radioactive material in the event of a release of radioactive materials during a severe transportation accident. An analysis of the potential importance of water pathway contamination for spent nuclear fuel transportation accident risk using a worst-case water contamination scenario (DIRS 157052-Ostmeyer 1986) showed that the impacts of the water contamination scenario were about one-fiftieth of the impacts of a comparable accident in an urban area.

8.10 (8746)
Comment - EIS001907 / 0008
One area of concern in nuclear waste transportation is the exposure of waste handlers, drivers and the general public to radiation even during routine (non-accident) conditions. Even though shipping containers are shielded and designed to reduce exposures to radiation being emitted by the spent fuel or high-level waste, federal regulations allow a low level of radiation to emanate from the casks. As we all know, even low-levels of radiation have adverse health effects.

Even after ten years of cooling, spent nuclear fuel emits dangerous levels of gamma and neutron radiation. A person standing one yard away from an unshielded spent fuel assembly could receive a lethal dose of radiation in less than three minutes. The surface dose rate of spent fuel is so great (10,000 rem/hour or more), that shipping containers with enough shielding to completely contain all emissions would be too heavy to transport economically.

Federal regulations allow shipping casks to nuke the public at about 10 millirems/hour at 2 meters from the cask. What happens to the driver? Does a standard driver then get 100 millirems per ten hours driving? Routine exposures become especially problematic in situations where the transport vehicle is caught in heavy traffic with cars and other vehicles in close proximity for extended periods. Routine exposures also are of concern when the cask vehicle is stopped for repair, fueling, inspections, etc. Were the cumulative health impacts to toll booth workers taken into effect? What about gas station attendants? Were these people even notified about this hazard passing through their work areas? Does that violate Occupational Safety and Health Standards?

Response
Chapter 6 of the EIS presents DOE's evaluation of public health and safety consequences of routine, incident-free transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mountain. The analyses used the RADTRAN 5 computer program in estimating exposure of members of the public who would live near shipment routes to low-level ionizing radiation from the shipments. The estimates include impacts to maximally exposed individuals who are postulated to live or work along or near routes where shipments would pass, including a person stuck in a traffic jam next to a shipment, person at a service station, railyard crew members, inspectors, and escorts. The results of these analyses are presented in Tables 6-9 and 6-12 for the national mostly legal-weight truck and mostly rail scenarios, respectively.

The impacts to maximally exposed individuals in the general public would be very low. For comparison purposes, the rate of exposure for a chest X-ray would be about 10,000 times greater than the rate of exposure of a maximally exposed individual 6 meters (20 feet) from a cask. This individual would need to be 6 meters from a shipment for 3 hours to receive the same dose from a chest X-ray that occurs in about 1 second. These radiation doses are low and would not be expected to result in any health effects and are well within regulations promulgated by the Nuclear Regulatory Commission. The Occupational Health and Safety Administration does not have jurisdiction over radiation safety. To the maximum practical extent, DOE would ensure that transport operations were conducted to reduce dose to members of the public to levels below those permitted by regulations.

The commenter was concerned about the radiation doses to truck drivers. U.S. Department of Transportation regulations limit the radiation dose rate in normally occupied areas of the vehicles to 2 millirem per hour (see 49 CFR 173.441) unless the carriers operate under an approved radiation protection program and crews wear personal radiation dosimeters. This regulation has been in force for decades and has provided adequate protection to truck drivers from the very low levels of radiation emitted by the shipping casks. In addition, annual exposure limits are applicable to truck drivers. As stated in Table 6-6 of the EIS, crew members were assumed to be limited to an 800-millirem radiation dose. Over 24 years, this would result in an individual exposure of 12 rem, which represents a slightly increased probability (0.005) of latent cancer fatality.

With respect to the comment that low levels of radiation have adverse health effects, on average, members of the public are exposed to approximately 360 millirem per year from natural and manmade radiation sources. This amounts to about 8,640 millirem (8.6 rem) for the 24 years of operation for the proposed shipments. Approximately 80 percent of this is a result of natural sources, such as radon in homes and buildings and terrestrial radiation from rocks and soil. Figure F-1 of the EIS shows the relative contributions by radiation sources to people living in the United States. The maximum individual resident along the route of the proposed shipments would receive about 5.4 millirem (0.0054 rem) over the 24 years of operation. Thus, the increase in exposure to radiation for this person

as a result of the proposed shipments would be about 0.0625 percent. This small exposure would not be expected to result in life-shortening or any other detrimental health effect. Additional background information on human health effects from exposures to radioactive and toxic materials is presented in Appendix F of the EIS.

8.10 (8822)
Comment - EIS002082 / 0003
And one thing, too with Yucca Mountain, and there's all the garbage, garbage going up to Yucca Mountain and the truck spills some kind of dirt over. They stopped the truck right there. I don't know what they done after that.

Response
DOE does not plan on shipping radiologically contaminated dirt to the proposed Yucca Mountain Repository. Chapter 6 and Appendix J of the EIS discuss accidents involving spent nuclear fuel, which does not resemble dirt.

8.10 (8956)
Comment - EIS001040 / 0005
According to DOE Document DE-ACO4-84A-25747 "These Wastes Have a Potential for Causing Great Harm." They are thermally hot (250,000 BTUS/Hour) and highly radioactive. A ruptured cask either in transport or in the dump would be a major environmental disaster that could contaminate a large area. The recent disaster in Japan would be nothing compared to a breach of containment.

Response
An accident that could rupture a cask during transport and contaminate a large area is an extremely unlikely occurrence. Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there could be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

8.10 (8957)
Comment - EIS001040 / 0006
In the NRC's [Nuclear Regulatory Commission's] Final Environmental Statement for the Callaway Plant NUREG-75/011 Section 5-11 states that during normal transport (without an accident 601,100 people would be exposed to gamma radiation due to transport of one shipment.

Response
The exposed populations from truck and rail shipments of spent nuclear fuel and high-level radioactive waste are discussed in Sections 6.2.3.1 and 6.2.3.2 of the EIS. For legal-weight truck shipments, the exposed population within 0.8 kilometer (0.5 mile) of the roads was about 10 million and for rail shipments, the exposed population within 0.8 kilometer of the railroads was about 16 million over the 24 years of operation.

8.10 (9057)
Comment - EIS001866 / 0009
All existing casks for the transport of waste emit some level of radiation. Casks can be licensed and used if they pass required tests and do not exceed emission limits when inspected. It is assumed that exposures to individuals, at these allowable levels, will not be harmful. When dose and exposure limits are analyzed, and justification for safety decisions explained, the implication is that the exposures are single incidents. There is no consensus regarding health effects and other adverse consequences of single low dose of radiation. However it is increasingly evident that multiple exposures pose multiple risks and that cumulative exposures increase the risk burden.

Response
In the EIS transportation analyses, the typical assumption is that radiation doses are for multiple exposures, not single exposures. For example, in Table 6-9 in Section 6.2.3.1 of the EIS, the radiation dose to residents along the

route, a person at a service station, and a resident near a rail stop are for exposures to multiple shipments. For cases such as exposure of a person in a traffic jam, it is unlikely that a person would be exposed more than once and the radiation dose is based on exposure to a single shipment.

DOE recognizes that, although studied extensively for over 75 years, there is still much that is not understood about effects related to exposure to low level radiation. However, the Department is not aware of any substantial, peer-reviewed literature that indicates disproportionate harm associated with exposure to low-level radiation.

Because of uncertainties in the low-dose/dose-region of the dose effect curve, DOE has selected, for use in the EIS, dose-to-risk factors recommended by the National Council on Radiation Protection and Measurements (DIRS 101856-NCRP 1993) and the International Commission on Radiological Protection (DIRS 101836-ICRP 1991) for estimating the risk of latent cancer fatality from exposure to ionizing radiation. These factors were developed based on the linear no-threshold hypothesis, which assumes that adverse health effects could occur from exposure to ionizing radiation regardless of how small the dose.

DOE, as well as national and international scientific advisory organizations such as the Federal Radiation Council, the International Commission on Radiation Protection (DIRS 147927-ICRP 1966), the National Council on Radiation Protection and Measurements (DIRS 101857-NCRP 1993), the National Academy of Sciences/National Research Council Committee on the Biological Effects of Ionizing Radiation (BEIR V) (DIRS 100473-National Research Council, 1990), and the National Academy of Sciences/National Research Council Committee on an Assessment of Centers for Disease Control Radiation Studies (DIRS 154539-National Research Council 1995), have recognized for many years that the use of dose-to-risk conversion factors based on the linear no-threshold hypothesis to estimate stochastic effects (such as latent cancer fatalities) from very low exposures to ionizing radiation can overestimate the actual risk. These organizations have been careful to point out over the years that the use of the risk factors derived using the linear no-threshold hypothesis will provide reasonable assurance the actual effect will not be underestimated. For these reasons, the linear no-threshold hypothesis has been accepted for use by Federal agencies—including DOE, the Environmental Protection Agency, and the Nuclear Regulatory Commission—for radiation protection and for estimating risk from exposure to ionizing radiation. Until such time as these advisory committees change their acceptance of the linear no-threshold hypothesis and the Federal agencies agree that these changes should be incorporated, DOE will continue to use risk factors recommended by the national and international advisory groups that are based on the linear no-threshold hypothesis.

8.10 (9452)
Comment - EIS001641 / 0004
Shipments by rail are more dangerous as there have been several catastrophic train accidents in the Cajon Pass in recent years.

Response
Chapter 6 of the EIS discusses the transportation impacts of shipping spent nuclear fuel and high-level radioactive waste to the repository. Over a 24-year shipping campaign, the EIS estimates that there could be about 17 fatalities if mostly trucks were used and about 10 fatalities if mostly trains were used. The analyses in the EIS show that the impacts of transporting spent nuclear fuel and high-level radioactive waste are low for both modes and do not provide a distinguishing basis for choosing a transport mode.

8.10 (9538)
Comment - EIS001888 / 0199
[Summary of comments noted by Clark County Nuclear Waste Division staff at various citizens' meetings.]

Hopeful that DOE would consider trucking impacts that were not really considered - "there will be accidents."

Response
The comment was not specific about trucking impacts the EIS did not consider. Chapter 6 and Appendix J of the EIS evaluate the impacts of shipping spent nuclear fuel and high-level radioactive waste by truck. Impacts of routine truck shipments would include radiological impacts from low-level radiation outside the shipping casks and nonradiological impacts from normal vehicle emissions. The EIS evaluates transportation accidents in terms of (1) radiological impacts from accidental releases of radioactivity, and (2) traffic fatalities.

8.10 (9580)
Comment - EIS001888 / 0254
This unprecedented high level of handling activity has never taken place before. Handling at an intermodal facility is just as problematic. There is no accident or incident data describing likely accidents handling spent fuel at intermodal facilities. A major cause of concern is the use of historical accident rates to describe the risks of a roadway not yet constructed. The DEIS assumes that the mostly truck alternative will use Clark County's northern and western beltways to transport spent fuel. These roads have not yet been constructed and there is no empirical data about accidents on these roadways.

Response
Appendix J of the EIS documents the methodology used for analysis of accidents that could occur during handling of spent nuclear fuel shipping casks at intermodal facilities. The analysis considered external initiating events (for example, seismic events, aircraft crash) and internal initiating events (for example, dropping a cask during transfer). Extensive empirical data exists regarding the design standards of the casks and the ability of the casks to maintain their integrity under a variety of accident conditions. The analyses performed for the EIS found no credible accidents with the potential for radioactive release at an intermodal transfer station.

The EIS uses accident rates for roadways based on state-specific rates of accidents involving interstate-registered combination trucks for 1994, 1995, and 1996. As the commenter points out, accident rates for new roadways that have not yet been constructed cannot be used in the analysis. However, new roadways would be constructed in accordance to state and U.S. Department of Transportation standards, and the accident rates for new roadways would not be expected to be greater than the rates for existing roadways.

8.10 (9722)
Comment - EIS002149 / 0002
Another issue I'd like to address is the transportation one very briefly. There are three things that are really important in this transportation problem. There's the testing we've heard about. There's real live accident scenarios, which we don't hear about too much and you don't really hear about them very much in this thing at all, and then there's the models which we hear a lot about. These three are three pieces that have to be connected, and to me and to Citizen Alert that the analysis, the risk analysis in this document, the transportation analysis is not complete unless those three concepts are connected.

How do the tests that we keep hearing about connect to real world accidents? That needs to be connected for people to understand. How do the models connect to real world accidents and the tests? That needs to be connected for people to understand the impacts. That is the responsibility of our federal agencies, the DOE and the NRC [Nuclear Regulatory Commission], and though that connection has not been made.

Response
Regulatory test conditions for Type B packages, such as spent nuclear fuel shipping casks, were developed about 40 years ago. The intent was to establish a set of laboratory test conditions that would provide consistent and reproducible results for package testing. Although they were originally derived from examining stresses from various types of severe accidents, they are not intended to simulate actual transportation accident scenarios. Rather, the package tests are intended to represent the actual stresses that could be imposed on a package during a severe accident. The logic behind this approach is that if a package is capable of withstanding the Type B package tests (see the hypothetical accident conditions defined in 10 CFR 71.73 and described in the EIS, Section M.4) without serious leakage, they could withstand most real accidents without major rupture or large release of the contents.

Part of the difficulty in designing the Type B package tests was reproducibility. The developers recognized they could not design tests that simulate real accidents because of large variability in the environment in which the accidents could occur. For example, they could have specified a test consisting of a 97-kilometer (60-mile)-per-hour impact into a real surface, such as rock or soil. However, the physical properties of rock and soil are variable from location to location, so the energy-absorbing characteristics of the surface affected by the shipping cask had to be specified for the tests to be reproducible. The test developers decided to specify an "unyielding" surface, which is easily modeled even though it does not exist in nature. The use of an unyielding surface means that all of the mechanical energy of a collision is absorbed by the shipping cask; that is, none of the energy is absorbed by the affected surface. The use of an unyielding surface results in greater package damage than a real surface, such as

other vehicles, rocks, etc., because real surfaces crush and thus absorb some of the impact energy. The test developers followed similar processes to arrive at puncture, thermal, and immersion test specifications. Based on information available to the test developers, they were confident that the Type B package tests they specified would encompass the vast majority of real accidents.

Licensing (or certification) of Type B shipping casks requires the approval of the Nuclear Regulatory Commission. An applicant submits detailed designs and safety analyses of the shipping cask to the Commission in a Safety Analysis Report for Packaging (SARP). The SARP contains, among other things, an evaluation of the effects of the Type B package tests on the shipping cask. The performance of the shipping cask under the Type B package test conditions can be evaluated using detailed computer codes and models that have been developed and improved over many years. Full-scale and half- or quarter-scale testing has been conducted to validate the predictions made by the computer models. In other words, predictions of package damage made by the computer codes have been compared to the actual damage produced in scale model testing and the computer codes have been determined to accurately predict package performance. Based on this experience, DOE and the Nuclear Regulatory Commission are confident that the computer codes and models used to demonstrate compliance with the Type B packaging requirements effectively and accurately predict the performance of the shipping casks when subjected to the Type B test conditions. Furthermore, successful demonstration of package performance under the Type B test conditions provides assurance that the package is capable of withstanding the vast majority of real transportation accidents.

8.10 (9936)
Comment - EIS001732 / 0010
During the Three Mile Island shipments there was an accident on the very same highly-inspected and maintained train tracks. Luckily, the accident did not involve the TMI shipment. The accident sticks in my mind because it was in a very hard to reach area that was also close to highly populated communities. The accident involved train cars hanging suspended off of a train trestle over a river. We do have rivers in Missouri. How many hours they hung there while [a] high-intensity, long-duration fire blazed beneath them while the emergency personnel struggled to get there, which severely delayed their response time.

What dangers would this type of accident present if the train cars were carrying casks containing high-level radioactive waste from nuclear reactors nation-wide?

Response
In the severe transportation accidents analyzed in the EIS, fully engulfing fires were analyzed. This means that the cask was assumed to be at the center of the fire, were the amount of heat transferred to the cask would be the greatest. At other locations, such as the cask dangling above the fire, the amount of heat transferred to the cask would be less and therefore, the amount of damage to the cask would also be less. Therefore, the consequences of the type of accident described by the commenter would be less than the consequences of the severe transportation accidents presented in the EIS.

The consequences of these severe accidents are presented in Sections 6.2.4.2.1 and 6.2.4.2.2 of the EIS, for truck and rail transportation, respectively. For a maximum reasonably foreseeable truck accident analyzed in the EIS, the estimated probability is about 2.3 in 10 million per year. The consequences of these accidents are presented in Section 6.2.4.2.

8.10 (10022)
Comment - EIS001888 / 0516
[Clark County summary of comments it has received from the public.]

Collateral Risk is sum of risks posed by activities effecting shipment. Example, 8% of County roads undergoing construction at any one time. Accidents go up significantly around construction. Some routes have high frequency of construction must include.

Response
DOE is aware of the U.S. Department of Transportation and state transportation agencies current emphasis on reducing traffic accidents in highway work zones. A review of work zone crash data available from the U.S. Department of Transportation indicated that the number of fatalities in work zone accidents nationally have

been relatively stable since 1980. In addition, fatalities in work zones were included in the accident data used in the EIS.

Use of accident data specific to work zones such as the commenter suggests would not materially affect the comparisons of alternatives and decisions to be made with regard to construction and operation of the proposed repository. The requested information could provide useful information for identifying and quantifying differences between alternative routes; however, DOE does not intend to designate preferred routes based on the EIS. Rather, this would occur in the future, and would be conducted in accordance with U.S. Department of Transportation routing guidelines. The preferred routes would be submitted to the U.S. Nuclear Regulatory Commission for approval. DOE would consider location-specific accident data during the route selection process. Furthermore, preshipment planning activities described in Section M.3.2 of the EIS would identify work zones on preferred highway routes and they would be avoided entirely by using an alternative preferred route, if possible, be accessed at times when traffic volumes are low, or wait in a safe parking area until heavy traffic clears. This would not always be possible due to the limited routing options available but would reduce the potential for accidents in work zones involving spent nuclear fuel and high-level radioactive waste shipments to the proposed repository.

8.10 (10055)
Comment - EIS001888 / 0536
[Clark County summary of comments it has received from the public.]

Clark County is in early stages of 10 year transportation improvement project. This results in increased accident risk this must be considered.

Response
The commenter appears to be concerned about potential transportation accidents in work zones. DOE is aware of the U.S. Department of Transportation and state transportation agencies current emphasis on reducing traffic accidents in highway work zones. A review of work zone crash data available from the Department of Transportation indicated that the number of fatalities in work zone accidents nationally have been relatively stable since 1980. In addition, fatalities in work zones were included in the accident data used in the EIS.

Use of accident data specific to work zones such as the commenter suggests would not materially affect the comparisons of alternatives and decisions to be made with regard to construction and operation of the proposed repository. The requested information could provide useful information for identifying and quantifying differences between alternative routes; however, DOE does not intend to designate preferred routes based on the EIS. Rather, this would occur in the future, and would be conducted in accordance with U.S. Department of Transportation routing guidelines. The preferred routes would be submitted to the U.S. Nuclear Regulatory Commission for approval. DOE would consider location-specific accident data during the route selection process. Furthermore, preshipment planning activities described in Section M.3.2 of the EIS would identify work zones on preferred highway routes and they would be avoided entirely by using an alternative preferred route, if possible, be accessed at times when traffic volumes were low, or wait in a safe parking area until heavy traffic cleared. This would not always be possible due to the limited routing options available but would reduce the potential for accidents in work zones involving spent nuclear fuel and high-level radioactive waste shipments to the proposed repository.

The routing of shipments of spent nuclear fuel by legal-weight truck would be in accordance with U.S. Department of Transportation regulations. These regulations limit shipments of highway route controlled quantities of radioactive materials such as spent nuclear fuel to Interstate System highways whenever possible. These regulations allow a state or tribe to designate alternate routes in accordance with Department of Transportation guidelines. In the absence of the identification of an alternate route by the State of Nevada, in the EIS DOE analyzed the routes that satisfied the Department of Transportation regulations. In the Las Vegas area, use of Interstate-15 to U.S. 95 to Yucca Mountain is the only existing Interstate Highway System route. The only current alignment of Interstate-15 is through the “Spaghetti Bowl,” and transportation of nuclear waste along this segment was analyzed in the EIS. However, the Beltway around Las Vegas would avoid this area. The impacts of using the Beltway were analyzed in the EIS.

8.10 (10385)
Comment - EIS001371 / 0010
The investigation into Amtrak's deadliest crash focused Thursday on a towboat operator who - 12 minutes before the crash - radioed that he was having a problem with a runaway barge.

The barge struck a railroad trestle over the foggy backwater of Bayou Canot early Wednesday just before the train plunged off the bridge into the water and exploded, killing at least 44 of the 210 people on board.

"The fact is, he was lost," said Coast Guard Capt. Michael Perkins, speaking of the pilot of the towboat Mauvilla. "While he was trying to gather up his barges, the train came along and the accident occurred."

Response
As discussed in Section J.1.4.2.3, the analyses in the EIS used current data to estimate the risks and consequences of rail and barge accidents. These data included accidents of all causes, including accidents of the type discussed by the commenter. As discussed in Appendixes J and M, most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not likely result in releases of radioactive materials from the shipping casks. The performance standards for the casks prescribed by the Nuclear Regulatory Commission were selected to ensure that less than 1 percent of real-world accidents would result in loss of cask integrity and release of radioactivity from the cask. These standards ensure that the casks would be extremely robust.

8.10 (10746)
Comment - EIS002101 / 0008
So those rods are hanging in the air on the cranes. They got what they call hot cells. That's very dangerous work. They're lowering it into the dry casks. One of those welds could be wrong. Who knows what's going to happen? We're not talking about one time, five times. We're talking about 30,000 shipments. Nobody talks about how many rods that is.

Response
The characteristics of the spent nuclear fuel to be shipped to the proposed repository are described in Section 1.2 and Appendix A of the EIS. Nearly all of the spent nuclear fuel to be transported to the repository would be in the form of intact fuel assemblies, which consist of an array of fuel rods (for example, a 7-by-7 array) held together by structural components. If loose rods were shipped, for example loose rods generated during fuel consolidation demonstrations in the 1980s and early 1990s or postirradiation examinations, they would be overpacked.

In addition, canisters of vitrified high-level radioactive waste and various categories of DOE spent nuclear fuel would be shipped to the repository. DOE estimates that, for the proposed action, approximately 53,000 shipments of spent nuclear fuel and high-level radioactive waste would occur under the national mostly legal-weight truck scenario and 13,000 shipments would occur under the mostly rail scenario.

Hot cells exist at many nuclear-industry related research and operations facilities across the country. The hot cells and equipment are designed to be operated remotely using a variety of means, including remotely operated cranes, manipulators, and conveyances. Hot cells are typically heavily shielded rooms that use steel or concrete shielding and leaded glass windows to control the radiation dose rates outside the cells. In addition, the hot cells are provided with controlled ventilation and filtration systems to prevent the flow of contamination to occupied areas, contain airborne radioactive materials, and filter radioactive materials from the exhaust air prior to its discharge to the environment. A large amount of experience has been gained since the 1940s on how best to design hot cells and conduct remote operations. In addition, a large experience base exists for handling spent nuclear fuel assemblies, including both underwater and dry handling operations, that has been factored into the designs of shipping casks and development of shipping cask and fuel handling operations. Based on this experience, DOE is confident that hot cell operations, spent nuclear fuel handling, and transportation of spent nuclear fuel would be conducted safely and within regulatory limits and adequate public and worker protection would be provided.

DOE recognizes that human errors cannot be totally eliminated during the fabrication and operation of the shipping casks. Section J.1.4.2.1 of the EIS presents a discussion of the potential effects of human error, including

undetected defects such as bad welds, on accident impacts. To minimize the impacts of human errors, the shipping casks would be fabricated under Nuclear Regulatory Commission-approved quality assurance programs. As indicated in the GA4/9 shipping cask Certification of Compliance, each shipping cask would be extensively tested prior to its first use, including radiographic and ultrasonic inspections of welds, load testing of lifting trunnions, pressure testing of the cask containment boundary, gamma scans of the depleted uranium shield, and other tests. Trained and qualified personnel would conduct all testing. The shipping casks would be subjected to periodic in-service testing and maintenance, such as seal replacement, visual inspections of seals and sealing surfaces, and leakage testing. In addition, all shipping cask handling, loading, unloading, testing, and maintenance operations would be conducted in accordance with detailed written procedures and by trained and qualified personnel. DOE believes these testing, maintenance, procedural, and personnel training requirements would minimize the likelihood and consequences of human errors during cask fabrication and operation.

8.10 (10905)
Comment - EIS000357 / 0024
Could corridors be designated as heavy-haul nuclear freight as a mitigating measure in order to alleviate concerns of motorists who wanted to avoid worse case scenario nuclear accidents? Wouldn't such a measure also reduce the possibility of exposure, if there was a highway accident causing a leak?

Response
Section J.3 of the EIS analyzes the impacts associated with using heavy-haul trucks. Potential heavy-haul truck routes in Nevada are highways identified by the Nevada Department of Transportation for shipments of overweight and overdimension loads. Permits that specify approved routing for heavy-haul truck shipments on Nevada highways would be issued by the Nevada Department of Transportation. Alternate routes could be designated by the State of Nevada as specified in 49 CFR 397.103. There are no regulations regarding the exclusive designation of a highway for "heavy-haul nuclear freight."

8.10 (11063)
Comment - EIS000610 / 0022
Page 6-17, 18, Section 6.21 national transportation. I understand the probability, and if one goes back and examines the train wreck that spilled thousands of gallons of toxic material into the Sacramento River, it probably is outside the limits for the model used by DOE. It only takes one to do significant damage.

The difference between all the past accidents and one that could occur transporting nuclear waste is that past accidents were cured in one lifetime, but the nuclear accident time to cure could extend over many lifetimes. The reference section is again laced with adjectives that do not belong in an engineering document.

If you can state it is not likely or very unlikely, state the probability.

Response
Probabilities of severe spent nuclear fuel accidents are presented in Section J.1.4.2.1 of the EIS. Over 24 years of truck shipments to Yucca Mountain there would be less than a 1-percent chance of an accident that could result in a release of radioactive material from a cask. The chance of a rail accident that would cause release from a cask would be even lower. The chance that such an accident would occur in any locale would be much less than 1 percent. Therefore, an accident such as the train derailment near the Sacramento River would not be likely to release radioactive materials from the casks into the river.

8.10 (11067)
Comment - EIS000610 / 0025
6-28, block at the bottom of the page. DOE uses the argument that if an accident is not reasonable, it is not analyzed. This is defined by the conditions that occur more often than one in ten million times a year. They eliminate any conditions that occurs less than that number.

The public should be told of what can happen because if it can, it will in the years that material is being transported. In other words, don't use that. I want to know outside of that, because I maintain if it can happen, it will happen during the time that you are transporting materials in this country.

Response
Environmental Impact Statements are not required to analyze worst-case accidents but they are required to analyze reasonably foreseeable accidents. DOE guidelines (DIRS 104601-DOE 1993) suggest that these include accidents with probabilities in the range of 1 in a million to 1 in 10 million per year. As discussed in Section 6.2.4.2 and J.1.4.2.1 of the EIS, the accident analyses in the EIS include these "maximum reasonably foreseeable accidents." In addition to accidents with a probability greater than 1×10^{-7} per year, the EIS presented the consequences from all accident severity categories presented in Sprung et al. (DIRS 152476-2000).

8.10 (11271)
Comment - EIS001814 / 0006
6.2 National Transportation

The potential accident scenarios detailed in the National Transportation analysis grossly underestimate the environmental and health effects that may be associated with accidents by truck or rail because it assumes that probability of any particular accident occurring is low. See 6.2.4.2. First, the DEIS merely assumes that "[r]adiological impacts of accidents on biological resources would be very small." 6.2 at 6-18. Such conclusory statements are inadequate to fulfill the agency's duties under NEPA [National Environmental Policy Act]. The project envisions nuclear waste being shipped from throughout the United States, the possibility of an accident in an area of high rainfall or at a railroad crossing over a river is wholly unexamined. Such accidents may be statistically "rare" but even a single occurrence could irreparably damage biological resources in the area in which it does occur.

Response
The EIS does not assume that the probability of any particular accident occurring is low. Rather, the EIS evaluates the probabilities and consequences for a complete spectrum of accidents, ranging from accidents with high probabilities and low consequences to accidents with low probabilities and high consequences. Generally, plants and animals are no more sensitive to radiation than are humans. Both acute and chronic radiation doses that do not adversely affect humans are not known to affect terrestrial species of plants and animals. *Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Standards* (DIRS 103277-IAEA 1992) reports that there is no convincing evidence that indicates that the current radiological dose standards for humans would harm animal or plant populations. In other words, if humans are adequately protected, plants and animals are likely to be adequately protected. For these reasons, DOE has concluded that there would be not be significant impacts on terrestrial species of plants and animals located along the transportation corridors.

8.10 (11364)
Comment - EIS002278 / 0001
I too would like to address some of my transportation concerns. Number one is that using the 85 mile-an-hour car running into the 20 cubic-foot block wall, or whatever it was, sounds great, but that wouldn't even be close to the amount of impact that you would have running head-on to another, say, cement truck or something coming at you from a two-lane road, say along the I-20 or U.S. 27 going towards Tecopa, or whatever highway is where you have head-on collisions with two vehicles traveling maybe 65 miles an hour apiece.

Response
In the analysis of accidents, severe collisions leading to mechanical damage and functional failure of a spent nuclear fuel shipping cask are termed "initiating events." A large number of specific initiating events can be identified by review of historic transportation accidents or by the imagination. Any initiating event, including a collision with a cement truck or other vehicle as suggested by the commenter, can be characterized in terms of its mechanical forces and heat. The event can then be categorized according to the matrix shown in Figure J-9 of the EIS, which was taken from a recent study conducted by the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000). As a consequence, it is not necessary to analyze every possible initiating event individually because the range of accidents included in Sprung et al. (2000) encompasses all credible initiating events.

Regardless of the specific initiating event, the severity of a transportation accident can be characterized by the combination of mechanical forces and heat involved in the accident. Mechanical forces account for the severity of the crash itself, while heat accounts for the severity of a fire that could be involved in the accident. Sprung et al. (DIRS 152476-2000) concluded that only a tiny fraction of all accidents, less than one in 10,000, would be severe enough to fail a spent nuclear fuel shipping cask. The reason for this is the rigorous design, performance, and

testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. This study reaffirmed that the spent nuclear fuel transportation regulations provide adequate protection of public health and safety.

8.10 (11405)
Comment - EIS002251 / 0003
A one-in-ten-million chance of an accident is too many for me to even fathom how somebody can come up with these kind of numbers. It is unbelievable. Okay, what happens if the transportation is interrupted? If you have a bridge that fails, and you have to reroute it? I see nothing about the added effects from extended length of transportation time.

Response
The EIS acknowledges that transportation accidents could occur during the transport of radioactive materials to the proposed Yucca Mountain Repository. In Section J.1.4.2.3.2, the EIS estimates that there could be as many as 66 accidents under the mostly legal-weight truck shipping scenario and 8 accidents could occur under the mostly rail scenario. A study recently conducted by the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000) concluded that only a tiny fraction of all accidents, less than 1 in 10,000, would be severe enough to fail a spent nuclear fuel shipping cask. The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. Based on these statistics, DOE does not expect an accident to occur that would result in a radiological release and subsequent environmental cleanup.

The methods and data used to estimate the 1 in 10 million per year probability are discussed in Section J.1.4.2 of the EIS. Rerouting of shipments because of adverse weather and road conditions is discussed in Section M.3.2.1.4.

8.10 (11432)
Comment - EIS002277 / 0003
I believe that the DEIS should look at the conditions in the Cajon Pass under high-wind conditions and not under stable wind conditions.

On J-70 a small fraction -- a small fraction, whatever that means, of the accidents could generate forces capable of damaging the casks.

Let me say this: If it can happen, it will happen in 30 years. So when you use adjectives of "small fractions may have," it will happen. As the gentleman said, the Titanic wasn't supposed to sink. It was man made. We are not God, and I think we can't build things that are that positive.

[Page] J-58 atmospheric conditions called neutral or average conditions. The reason I keep raising this condition question is I keep getting the fact that it is – I don't want to see "average" when we talk about conditions in certain areas of California which have very radical atmospheric conditions compared to the rest of the country.

Atmospheric conditions called "neutral average conditions likely to prevail during a severe accident or an act of sabotage." Now, what makes people think that they won't do it under a Santa Ana wind condition? I don't understand why that – in the wintertime we have a lot of Santa Anas. So I think these are things that have to be relooked at in the transportation area. More specific figures, not adjectives.

Response
The EIS acknowledges that transportation accidents could occur during the transport of radioactive materials to the proposed Yucca Mountain Repository. In Section J.1.4.2.3.2, the EIS estimates that there could be as many as 66 accidents under the mostly legal-weight truck shipping scenario and 8 accidents could occur under the mostly rail scenario. A study recently conducted by the Nuclear Regulatory Commission (DIRS 152476-Sprung et al., 2000) concluded that only a tiny fraction of all accidents, less than 1 in 10,000, would be severe enough to fail a spent nuclear fuel shipping cask. This is the "small fraction" referred to by the commenter. The main reason that only a small fraction of accidents are severe enough to result in failure of the shipping casks is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste

shipping casks. Based on these statistics, DOE does not expect an accident to occur that would involve radiological consequences.

Two sets of atmospheric conditions were used in the transportation impact analysis. These are referred to in Section J.1.4.2.1 of the EIS as "neutral or average" and "stable." Neutral or average conditions are those that would not be exceeded more than 50 percent of the time and stable refers to conditions that would not be exceeded more than 95 percent of the time. Under stable conditions, wind speeds are usually very low [on the order 1 meter (3.3 feet) per hour]. Stable atmospheric conditions and low wind speeds result in minimal dispersion of the radioactive materials released from a potential transportation accident; that is, the plume of radioactive material would slowly move downwind and would be dispersed slowly. This means that the concentrations of radioactive material in the plume, and thus the consequences to individuals and populations in the area through which the plume passes, would be higher under stable conditions than they would be under less stable conditions with high winds. Under unstable or neutral atmospheric conditions, the plumes of released material spread out further and more rapidly than under stable, low-wind conditions. Thus, if an accidental release occurred under Santa Ana wind conditions, a lower radiation dose would be predicted than the EIS predicted in using the two sets of atmospheric conditions described above.

8.10 (11487)
Comment - EIS002253 / 0003
There has to be, I believe, almost a mile-by-mile, half-mile-by-half-mile evaluation of the tracks all the way to Yucca Mountain. And if they find these tracks deficient, in cooperation with the railroad, get them fixed. Put them at such a level that they never will be afraid of putting those casks on those trains, because they know that track won't fail.

The failures of coming down Cajon Pass, by the way, were trains coming down. You remember the one ten years ago that ran right into a neighborhood, an out-of Control train. It was because of the train, it wasn't the track. And it ran right into a neighborhood and obliterated a neighborhood and buried it in soda ash. And it was because it was coming down, not up.

Response
The U.S. Department of Transportation is the Federal agency responsible for establishing and enforcing the standards for the transportation infrastructure. The Department of Transportation's Federal Railroad Administration is responsible for safety of the rail system, including track, locomotives, highway crossings, incident reporting, brake systems, etc. (see 49 CFR Parts 200 to 266). The Federal Railroad Administration provides funds to states for track and train inspectors. The Federal Railroad Administration and state inspectors conduct the track inspections suggested by the commenter. Owners of track and rights-of-way continuously perform maintenance and upgrade activities to keep railroads safe. The Federal Government would own the tracks and the rights-of-way for the branch rail line in Nevada and would be responsible for conducting maintenance and repair. Nationally, the rail companies own their tracks and rights-of-way. The rail companies are responsible for maintenance and repair of their own tracks and rights-of-way. DOE and private rail lines would conduct inspection, maintenance, and repair activities as required by the Federal Railroad Administration and the states.

In general, adequate rail lines, crossings, bridges, and tunnels exist to support the transportation of materials described in the EIS. The shipment of radioactive materials requires no special transportation infrastructure that is not necessary for safe transport of commodities in the United States today.

In spite of all the precautions to be taken to prevent accidents such as the out-of-control train mentioned by the commenter, the EIS acknowledges that transportation accidents could occur during the transport of radioactive materials to the proposed Yucca Mountain Repository. In Section J.1.4.2.3.2, the EIS estimates that there could be as many as 66 accidents under the mostly legal-weight truck shipping scenario and 8 accidents could occur under the mostly rail scenario. A study recently conducted by the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000) concluded that only a tiny fraction of all accidents, less than 1 in 10,000, would be severe enough to fail a spent nuclear fuel shipping cask. The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level waste radioactive shipping casks. Based on these statistics, DOE does not expect an accident to occur that would involve radiological consequences.

8.10 (11493)
Comment - EIS002254 / 0006
We had a big accident three weeks ago through our community, a dripping waste truck came through. So don't tell me that that's not what's going on every day here in this country. Don't tell me that lie again.

Response
DOE would not use defective or leaking casks to ship spent nuclear fuel and high-level radioactive waste. The Nuclear Regulatory Commission and the U.S. Department of Transportation regulate the design, manufacture, maintenance, and use of these casks. Specific controls include (1) independent Nuclear Regulatory Commission review of designs to ensure compliance with requirements in 10 CFR Part 71, and (2) Nuclear Regulatory Commission-approved and audited quality assurance programs for design, manufacturing, maintenance, and use of transportation packages.

8.10 (11571)
Comment - EIS002281 / 0001
The routes going through San Bernardino and Riverside counties, Inyo County – I lived in Inyo County for two years, and I can attest to what was described about Route 127 as being a paved-over wagon trail, as that is exactly what it is. I have driven that many times. It is a two-lane road, definitely not made for heavy trucks of any stretch of the imagination, yet I do know they pass over it.

If a nuclear accident happened, if something happened on that stretch of highway, who would know about it? It is not traveled that extensively, except maybe when they have the dune races out at Dumont Dunes.

It is dangerous. It crosses sacred Indian land. Any time the government decides that it's just empty land and it's just a few people out there, it smacks of environmental racism. Poor people, people of color, are always the ones who get impacted with this the most. This cannot be allowed.

It's dangerous, and again I cannot emphasize more than has already been said, coming through Cajon Pass, an accident there is catastrophic. An accident coming through Los Angeles between Orange County and San Bernardino, you can hardly tell where one city stops and the other one begins. Anything through there – and how many times do you see or hear of accidents that involve big-rig trucks? For whatever reason, somebody cuts it off, some little foreign car cuts it off, or just traveling a bit too fast and losing control on a wet highway.

Response
Presently, State Route 127 is not a preferred highway and thus could not be used for shipments of spent nuclear fuel and high-level radioactive waste to Yucca Mountain. However, should the State of Nevada or California designate this highway as an alternate preferred route, it could do so only in accordance with U.S. Department of Transportation guidelines. The regulations require the State to select routes in accordance with the Department of Transportation *Guidelines for Selecting Preferred Highway Routes for Highway Route Controlled Quantity Shipments of Radioactive Materials* or an equivalent routing analysis that adequately considers overall risk to the public. Consultation with affected states and local jurisdictions would be necessary. The affected routing authorities would consider the conditions of State Route 127, including emergency response capability, highway design and condition, population density, traffic conditions, etc., during the process of selecting and designating alternative preferred routes.

The EIS examines the issue of environmental justice in Section 6.3.4. DOE believes that there would be no disproportionately high and adverse impacts to minority or low-income populations as a result of the Proposed Action.

As discussed in Section J.1.4 of the EIS, the release of radioactive materials during an accident is an extremely unlikely event (an annual probability of 0.01 percent. Transportation safety related to potential release of radioactive materials is primarily based on the integrity of shipping casks. The leaking of a transportation cask could only occur if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. Additional information on the safety and testing of transportation casks is provided in Section M.4. Information on human behavior is included in the accident rates and discussed in Section J.1.4.2.1.

8.10 (11581)
Comment - EIS002235 / 0004
As you have heard stated previously today, last week we focused our attention on the top of the Cajon Pass with 58 cars, five big rigs, and a massive pile-up that it took hours to untangle. Not uncommon here. What many of us didn't see was that at about two o'clock on the same day a county fire employee was first on scene on Interstate 10 at another massive accident and began rendering aid to victims, our citizens, as cars continued to crash -- literally crash around him.

What that brings up is that under even DOT (sic) predictions, with an unopened cask one may receive 10 millirems per hour at 10 meters, which is approximately 5 percent of the annual average dose that one would expect naturally.

In the event of an accidental release, particulates would be borne by desert and Santa Ana wind conditions for many, many miles, and the inhalation hazard would be catastrophic.

The DOE itself claims that in an accidental release, a 42-square-mile area would be contaminated and require 460 days to decontaminate it, and cost over 620 million dollars.

Response
Sections 6.2.4.2 and J.1.4.2 of the EIS evaluate severe transportation accidents such as the one described by the commenter. A severe truck accident is an extremely unlikely event (an annual probability of 1.9 in 10 million) per year. The consequences of this accident were estimated to be 18 latent cancer fatalities. The dose to the maximally exposed individual would be about 4 rem. These consequences include the radiation doses from inhaling radioactive material released during the accident. In addition, DOE assumed that emergency response activities such as evacuation would not take place, which provides conservative estimate of potential impacts.

The allowable dose from a closed, loaded cask is 10 millirem at 2 meters (6.6 feet).

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10 (11906)
Comment - EIS000996 / 0001
The Mississippi River provides 70 percent of the Nation's water resources and its boundaries as a water resource begin in the East in Appalachian Mountains and in the West in the Rocky Mountain Range. Drainage to the Mississippi River to the north and south is defined within the entire range of the United States and all the way North into Canada as well. Along the drainage system are 76 and 103 operating commercial reactors. Most of the shipments of radioactive materials are designed for storage in the Yucca Mountains will pass through this water resource area. The potential devastating effects of the gases released from the fission processes of radioactive nucleotides within these used cells being transported is unknown. What is known is that these gases will get into water resources of the Mississippi River drainage system and will affect our food, our water, and that for the billions of plants and animals that depend on this water. What would happen if an accident occurred and one of the shipments might fall into the water and affect 70 percent of the nation's water resource could be even more devastating. I question the validity of the casks, which are storing radioactive materials capable of keeping fission products from escaping. What is the capacity, should these casks fall from trucks or trains carrying them to withstand physical destruction?

Response
The EIS does not specifically analyze a transportation accident involving contamination of surface water such as the Mississippi River. Analyses performed in previous EISs (see Section 1.5.3 of the EIS) have consistently shown that the airborne pathway has the greatest potential for exposing large numbers of people to radioactive material in the

event of a severe transportation accident. A paper that analyzed the potential importance of water pathway contamination for spent nuclear fuel transportation accidents using a worst-case water contamination scenario (DIRS 157052-Ostmeyer 1986) showed that the impacts of the water contamination scenario were about one-fiftieth of the impacts of a comparable accident in an urban area. Therefore, if an accident occurred and one of the shipments fell into the water, the impacts would be much less than the impacts presented for the severe transportation accidents analyzed in Chapter 6 and Appendix J of the EIS. Many studies have shown that when people are protected, animals and plants are protected.

The casks used to transport spent nuclear fuel must meet stringent standards established by the Nuclear Regulatory Commission (10 CFR Part 71). These standards include requirements for keeping fission products from escaping during normal transportation and during severe accidents. The consequences of severe transportation accidents are presented in Section 6.2.4.2 and Appendix J of the EIS. Though a severe accident that releases radioactive materials is not expected to occur during the 24-year campaign, DOE has performed an analysis of a maximum reasonably foreseeable accident. Section 6.2.4.2 presents the results of the analysis. Section J.1.4.2 presents details on the data, methods, and assumptions used to estimate these consequences. Section M.4 contains more information on the safety and testing of transportation casks.

8.10 (12031)
Comment - EIS001879 / 0055
A careful review of the Draft EIS was unable to identify any evaluations of the consequences of an avalanche related transportation accident or [an] accident scenario whereby a cask plummets down a steep rocky slope. While the probability of such an event is apparently included within the analyses presented in the Draft EIS (in terms of reportable traffic incidents which would include these types of events), it does not appear that the severity is accounted for adequately.

There are numerous avalanche detection monitors and rock fall fences located along the Union Pacific Railroad lines in Clover Valley, immediately east of Caliente, Nevada. Discussions with railroad employees indicate that rock falls and avalanches are a common occurrence, that train cars are often hit, and that in some cases, boulders as large as boxcars have fallen onto the railroad tracks. Other portions of rail routes through mountainous terrain probably also have similar occurrences. The Draft EIS does not contain any evaluation of the consequences of a rock fall or avalanche along transportation routes (both rail and truck) or how such events would rank in the probability/severity matrix given in Figure J-8. The EIS must be revised to include an evaluation of the consequences of a rock fall or avalanche.

The Draft EIS does not evaluate the scenario of a traffic accident that results in a cask falling down a steep rocky slope. A review of the source documentation (NUREG/CR4829, Fischer et al. 1987) indicates that only single impact scenarios were evaluated and that one of the key factors is the maximum effective strain on the containment shell of the cask. No evaluations were made of multiple impact scenarios such as a cask falling down a slope. Under a multiple impact scenario, numerous breaches could occur and much more severe breaches are likely; as a result, the release fractions from the fuel rods to the casks could be much higher than those originally estimated by Oak Ridge National Laboratory (see Lorenz et al. Fission Product Release from Highly Irradiated LWR Fuel, NUREG/CR-0722 as referenced in Fischer et al. Shipping Container Response to Severe Highway and Railway Accident Conditions, NUREG/CR-4829). The EIS must be revised to include an evaluation of multiple-impact scenarios especially with regard to release fractions from multiple impact and cask breach scenarios.

Response
The commenter requested analyses of specific accident scenarios involving avalanche-related accidents and shipping casks falling down a steep rocky slope. In the analysis of accidents, these events are termed “initiating events.” A large number of specific initiating events can be identified by review of historic transportation accidents or by the imagination. These include collisions with fixed objects (bridge abutments, walls, barriers, etc.); collisions with other vehicles and animals; rollovers; jackknife; derailments; and collisions at grade Crossings. Any initiating event can be characterized in terms of its mechanical forces and heat, and the event can then be categorized according to the matrix shown in Figure J-9 of the EIS, which is the transportation accident risk model used in the EIS. This model was taken from a recent study conducted by the Nuclear Regulatory Commission, *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). As a consequence, it is not necessary to analyze

every possible initiating event individually because the range of accidents included in Sprung et al. (2000) encompasses all credible initiating events.

Regardless of the specific initiating event, the severity of a transportation accident can be characterized by the combination of mechanical forces and heat involved in the accident. Mechanical forces account for the severity of the crash itself, while heat accounts for the severity of fire that could be involved in the accident. Sprung et al. (DIRS 152476-2000) concluded that only a tiny fraction of all accidents, less than 1 in 10,000, would be severe enough to fail a spent nuclear fuel shipping cask. The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. This study reaffirmed that the spent nuclear fuel transportation regulations provide adequate protection of public health and safety.

The massive shipping casks are designed to sustain severe damage without resulting in functional failure. In addition, the shipping casks are protected by crushable impact limiters that absorb impact energy that would otherwise be applied to the shipping cask. Furthermore, the shipping casks are attached to trailers and railcars that would absorb additional impact energy as long as the shipping casks remain attached. Finally, the actual surfaces that the shipping cask would strike in a collision event, such as the ground, rocks, or other vehicles, would absorb some of the impact energy. Therefore, although the specific initiating events suggested by the commenter might not be explicitly evaluated in the EIS or in Sprung et al. (DIRS 152476-2000), the damage to the shipping cask and its cargo is included in the accident model shown in Figures J-9 of the EIS.

8.10 (12032)
Comment - EIS001879 / 0056
The Draft EIS does not include information on how the judgments regarding the release fractions were made. As noted by Lorenz et al. (as cited above, page 9-23), "...the ORNL [Oak Ridge National Laboratory] test data may or may not overestimate the actual releases under high-impact conditions," and on page 9-29,..." The results of this study depend primarily on the quality of the cask response models, the radiation release models, and the probability models and distributions used in the analysis.... If the objective of this study is to precisely define spent fuel transportation risk, many improvements need to be made to these models to calculate the probability and radioactive release estimates and to quantify the uncertainties in the estimates." The EIS should state that the maximum release scenario is based upon limited tests, mathematical models that incorporate a number of simplifying assumptions, and professional judgment.

Response
The EIS has been revised to use the release fractions from the U.S. Nuclear Regulatory Commission study *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000) to estimate the risks and consequences of transportation accidents. The methods and data used to estimate these release fractions are summarized in Section J.1.4.2 of the EIS and are discussed in more depth in Section 7 of Sprung et al. (2000).

8.10 (12093)
Comment - EIS002307 / 0007
Section 6 of the DEIS is incorrect in the assessment of train accident risks because the DEIS, assuming that the highway and rail conditions will be similar, relies on data from highway conditions to compute train accident risks.

Response
As discussed in Section J.1.4.2.3, the EIS uses train accident data to estimate train accident risks, and does not use highway accident data to estimate train accident risks.

8.10 (12135)
Comment - EIS001887 / 0437
Inputs to computer models predicting exposure levels

3.1. Use of temperature and strain as independent variables
Refer to Resnikoff, 1993. In many severe accidents, high impacts are coupled with vehicle fires. In predicting probabilities of accidents of a given severity, the probability of fire of a certain severity is multiplied by the

probability of an impact of a given strain. This tends to underestimate the "true probability" of strain-fire accidents, as these two variables are not independent. This is another artifact of the Modal study needing revision.

3.2. Inconsistent assumptions made in RADTRAN4 and RISKIND

3.2.1. DOE employs RADTRAN4 for total risk, summing individual accident probabilities multiplied by consequences. RISKIND is employed to assess the maximum accident consequences. The assumptions employed should be identical, but they are not. RADTRAN4 assumes ingestion of contaminated food after an accident in rural areas in determining collective population dose; RISKIND assumes no radiological dose to populations from ingestion of contaminated food after an accident in determining maximum accident scenarios. It is unclear why these two inputs are different.

3.2.2. In calculating effects to the maximally exposed individual in an accident scenario, the EIS assumes that this person is located 360 meters (~1200 ft) from the site. In calculating effects to the maximally exposed individual in sabotage scenario, the EIS assumes this person is 140 meters (~460 ft) from the site. It is unclear where these distances came from, or why they are different.

3.3. Incident-free exposure assumptions

3.3.1. Escorts
DOE based its estimates of annual dose to escorts on regulations that we believe are insufficient to ensure the safety of the transportation vehicles. We recommend that these requirements be increased so that there is always at least one armed escort traveling in a separate vehicle from all truck shipments, and in separate rail cars for all train shipments. This will increase the estimated dose to escorts.

3.3.2. Individuals stuck in traffic
DOE assumes that individuals exposed to radiation dose due to being stuck in traffic near a transportation vehicle will occur only once per individual. However, personal driving patterns are not random, since people (especially commuters) tend to be on the same road at the same time of day. Therefore, persons being stuck in traffic near a transportation vehicle once are likely to be stuck multiple times.

3.4. Population density

The EIS uses average population densities from the 1990 Census to estimate the "worst case" accident and sabotage scenarios. This ignores time-dependent, such as daytime population densities in cities due to worker commuting (Manhattan's population doubles every day), tourist population densities, special-event and localized densities. The maximum population densities used in the RISKIND code should reflect these factors.

3.5. Characteristics of spent fuel used in accident consequence estimates

3.5.1. Age of spent fuel

Simply put, the longer a given type of fuel is removed from a reactor prior to shipment, the less radioactive it is. Fuel which has cooled for a long time has had the time to undergo decay reactions, reducing its level of radioactivity. The DOE assumes in its estimates a spent fuel age of 25.8 years, even though fuel is only required to be cooled for 5 years prior to transportation. This results in a reduced estimate of hazard. Unless the DOE can show through legal requirements that spent fuel will be aged 25.8 years prior to shipment, it is not appropriate to use this age in its exposure assessments for incident-free and accident scenarios.

A more likely scenario is that older fuel, already stored in storage casks at reactor sites or at the proposed PFS [Private Fuel Storage] storage facility in Utah, will remain stored while newer fuel, stored in fuel pools, but aged more than five years, will first be transported off the reactor site so that reactors can be decommissioned more rapidly. DOE has established an acceptance quota for reactor fuel; for utilities, the most advantageous use is to further reactor decommissioning. Further, DOE would have to pay the cost of casks and transportation of this newer fuel. Older fuel would then be shipped at a much later date.

In a 25.8–year period, important radioactive contaminants in irradiated fuel will have decayed away. For example, Co^{60}, a main contributor to radiation dose from crud spallation, has a half-life on the order of 5 years. Concentrating on 25.8-year fuel decreases the amount of Co^{60} modeled by a factor of 2^5, seriously reducing possible radiological effects in the event of a release.

Response

3.1 At the time the Draft EIS was published, DOE considered *Shipping Container Response to Severe Highway and Railway Accident Conditions* (DIRS 101828-Fischer et al. 1987; also called the Modal Study) to contain the best available information regarding spent nuclear fuel transportation accidents. However, the U.S. Nuclear Regulatory Commission has recently published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000), which contains additional information regarding spent nuclear fuel transportation accidents, including the use of different shipping cask designs than the representative steel-lead-steel cask used in the Modal Study. Because Sprung et al. (2000) provides more recent information and is based on the most recent shipping cask designs, DOE has conducted an analysis using the information from that document. The results of this analysis are presented in Appendix J of the EIS and show that the impacts estimated in the EIS using the Modal Study exceed the impacts estimated using Sprung et al. (2000). As a consequence, the Draft EIS overestimated the impacts of spent nuclear fuel transportation accidents and the Final EIS contains more realistic estimates of spent nuclear fuel transportation accident impacts.

DOE agrees with the commenter that impact and thermal conditions in transportation accidents are not independent of each other. For example, one would expect that fires are more likely to occur in high-speed impacts than in low-speed impacts. In essence, Sprung et al. (DIRS 152476-2000) assumes three general sequences of events could lead to a release. These are (1) severe collision events without fires, (2) collisions followed by fires, and (3) fire only. These variables are not treated independently, as indicated in Section 7.2.8.1 of Sprung et al. (2000), but rather the probabilities of fires are dependent on the particular accident scenario that occurs (truck accident scenarios are depicted in Figure 7-3 of that document).

3.2.1 The commenter is correct in that the integrated population risk calculation included doses from ingestion of contaminated foods for accidents in rural areas only, whereas the analysis of maximum reasonably foreseeable accidents did not include ingestion. DOE's experience with this and other EISs as well as many other radiation dose studies is that ingestion doses are small in relation to inhalation and direct external exposures. In general, the population doses from the maximum reasonably foreseeable transportation accidents would be highest in urban areas where population densities are highest. Since little agricultural production occurs in urbanized areas, ingestion of crops that have become contaminated by a release of radioactive materials would not occur. In other words, the assumed population densities have a much stronger effect on population dose consequences than does including/excluding ingestion doses. In this context, the absolute magnitudes of the results are less important than the consistent treatment of assumptions and uncertainties. Since the integrated population risks calculated by RADTRAN are not compared to the consequences of maximum reasonably foreseeable transportation accidents, differing assumptions about ingestion would not affect the comparisons among alternatives in this EIS. Therefore, DOE believes the effects of these differing assumptions are small and, in addition, would have no effect on the decisions to be made in this EIS.

3.2.2 The distance to the maximum exposed individual is a function of the prevailing atmospheric conditions at the time of a release of radioactive material and the height of the release. For example, consider an accident that involves a serious fire. If material was released from a shipping cask, the fire would initially cause the released material to be transported upward. We have all seen large fires on television news in which the cloud of smoke rises directly up from the source of the fire. As the released material gets farther from the fire, the released particles cool and the forces of gravity would begin to bring the particles back to the ground. The effects of wind and weather would cause the particles to be transported downwind. Because of the initial upward movement of the plume, the location of the highest concentrations of released material would be at some distance downwind of the accident scene, depending on the severity of the fire, wind speed, and atmospheric stability. If a release occurs that is not accompanied by a fire, the initial vertical (upward) movement does not occur or is relatively weak and the plume of released material remains close to the ground. Therefore, the maximum concentration of particles would be closer to the accident scene for a nonfire scenario than it would be for an accident that involves a fire. In a sabotage event, the released material does not have the same vertical driving force that a long-duration fire produces. Thus, the

particles remain near ground level and the maximum concentrations are nearer to the release point than they would for a fire-driven release.

3.3.1 The Nuclear Regulatory Commission's regulations in 10 CFR Part 73 prescribe safeguards and security requirements for spent nuclear fuel shipments. These safeguards, which include armed escorts in urban areas, should be effective in reducing the likelihood of a successful attack to low levels. In addition to armed escorts in urban areas, the requirements include tracking, reporting, route planning and prenotification. Prenotification of the timing and routes used for shipments would be held in confidence as a matter of security, but state governors' offices would be made aware of schedules. These operational actions would be supplemented by the robust nature of the cask itself, which would make an attack that was not thwarted by the safeguards measures even more unlikely of success.

Application of the urban escorting requirements in all areas would have drawbacks without any significant increase in overall security. The drawbacks would relate to the additional radiological exposure, as stated by the commenter, and increased potential for accidents involving the escort vehicles. Armed guards would be required in heavily populated areas because the total radiological impact in such areas would be higher than in less populated areas. In neither area is it expected that doses to individuals would be markedly different or above levels that could have health effects. Thus, individuals in high, medium, and low population areas are treated equally.

DOE sees no particular need for additional security measures over and above those that would be provided as a result of applying the Nuclear Regulatory Commission safeguards requirements in place at the time of the shipments. As stated in the EIS, escorts are required in heavily populated areas. These areas are defined in a list that is provided by the Commission as part of its requirements for safeguarding spent nuclear fuel in transportation. Section M.7 of the EIS provides additional information on physical protection of spent nuclear fuel in transport.

3.3.2 A defensible basis for estimating the number of times that a person could be stuck in traffic next to a spent nuclear fuel shipment could not be established. It is extremely unlikely that even one occurrence would be experienced, given the number of vehicles on the highways in relation to the number of spent nuclear fuel shipments occurring at a given time. Approximately six shipments per day would be received at the repository over the 24-year operating period of the repository under the national mostly legal-weight truck scenario. As stated in Section 3.2.2 of the EIS, legal-weight truck shipments would represent less than 0.5 percent of commercial vehicle traffic on U.S. 95 (and an even smaller fraction of total commercial plus private vehicle traffic). Although certain people are more likely to be on a highway at a given time (for example, commuters during rush hour), the likelihood of any individual being stuck next to a shipment even one time is approximately random due to the great number of vehicles that would also be on the highway in relation to the number of spent nuclear fuel and high-level radioactive waste shipments. As stated in Section M.3.2, during preshipment planning, the Regional Servicing Contractors should consider preferred time of day travel through urban areas as part of routing determinations. The intent is to schedule departures so avoid traveling through urban areas during rush-hour periods. Real-time tracking and communications systems provide the capability to relay information to drivers on upcoming road and weather conditions. Preshipment planning and real-time tracking and communications would therefore reduce the likelihood of such an event.

3.4 The precise timing, location, and other circumstances surrounding a transportation accident cannot be predicted. In addition, it would not be practical for the EIS to attempt to analyze accident consequences for every location along the shipping route. Instead, maximum consequences were analyzed for three types of population zones: urban, suburban, and rural. For example, an accident in the Las Vegas area would be characterized by the analysis for an urban area. Tables 6-14 and 6-15 of the EIS provide the estimated impacts of the maximum reasonably foreseeable accident in an urbanized area for truck and rail, respectively. Table J-24 shows consequences of maximum reasonably foreseeable accidents in urbanized and rural areas.

The EIS does not analyze a worst-case accident, as the commenter suggests. Rather, the EIS used the concept of a maximum reasonably foreseeable accident, which is sometimes misinterpreted as being a worst-case accident. An example of a worst-case transportation accident would involve a shipment containing the highest possible quantity of spent nuclear fuel or high-level radioactive waste, in a highly populated area, with catastrophic failure of the shipping container, an engulfing fire lasting many hours, and stable weather conditions (very low atmospheric dispersion of plume). However, this worst-case accident scenario would not be reasonably foreseeable because it

requires the simultaneous occurrence of a series of unlikely events, which, compounded, result in a likelihood of occurrence that is less than once in 10 million years. Council on Environmental Quality regulations (40 CFR 1502.22) state that analysis of accidents should avoid scenarios that are based on pure conjecture and avoid compounding conservatisms. The practice of compounding conservatisms produces unrealistic results that mask the real differences between alternatives and would not produce suitable results to support choices among the alternatives.

3.5 The commenter pointed out that the assumptions used in the EIS for the age and radiological characteristics of spent nuclear fuel in the maximum reasonably foreseeable accident scenarios could understate the transportation risks. It is true that DOE could ship some spent nuclear fuel that is more radioactive than the 26-year-old pressurized-water reactor spent nuclear fuel analyzed in the scenario. Based on comments received and DOE's additional review of technical documents and conduct of hazard analyses, the basis for the transportation impact analysis has been revised to consider commercial spent nuclear fuel that has median hazard. Spent nuclear fuel having median hazard would be discharged from a reactor approximately 14 years before shipment to Yucca Mountain. If any 5-year-old or 10-year-old spent nuclear fuel was to be shipped to the repository, it would be a small fraction of the total shipments. This is a case in which "average" data is used in the EIS as opposed to bounding assumptions. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing accident scenarios. Other elements of the impact analyses (for example, radiation dose rates, atmospheric dispersion modeling, release fractions) are bounding such that the transportation impact results presented in the EIS are bounding, yet not so conservative that the results mask the true differences between the alternatives.

8.10 (12136)
Comment - EIS001887 / 0438
Improper attention to Intermodal Transfer Station

4.1. Crash scenarios analyzed

4.1.1. Airplane crash scenario

The airplane crash scenario assumes that the crash velocities will be those typical of takeoff and landing operations. As a worst case scenario, the potential impact of a crashing military jet traveling at 600 mph should be considered. This is likely to cause release of some radioactive material.

Response
The methodology employed in the EIS to estimate penetration characteristics of large aircraft projectiles into shipping casks was based on extensive research that is summarized in DOE-STD-3014-96, *Accident Analysis for Aircraft Crash into Hazardous Facilities* (DIRS 101810-DOE 1996). This document and its supporting studies contain the best available information on aircraft crash probabilities and the effects of aircraft crashes on systems, structures, and components. The studies include this information for commercial, general aviation, and military aircraft crashes. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices would provide misleading information and lend credibility to accident scenarios that are clearly insignificant contributors to the true risks of an intermodal transfer facility. If DOE decided to construct an intermodal transfer facility in Nevada, it would conduct additional aircraft hazard analyses to support nuclear facility safety analyses and designs of structures, systems, and components important to safety. DOE believes the aircraft hazard analysis summarized in the EIS would probably not be adequate to support detailed design and safety analyses of an intermodal transfer facility but is adequate for its intended purpose of informing the reader about the potential likelihood and consequences of accidents related to transportation of spent nuclear fuel and high-level radioactive waste to the proposed repository.

Bechtel-SAIC Company (DIRS 157210-BSC 2001) estimated the potential releases of radioactive materials that could result from the crash of a commercial jet airliner into a shipping cask containing spent nuclear fuel. According to the analysis, the release from a rail cask struck by a jet engine traveling 640 kilometers (400 miles) per hour and exposed to the ensuing jet-fuel fire would be no greater than the releases in a severe rail transportation accident in which the cask impacted a hard rock surface at between 48 and 97 kilometers (30 and 60 miles) per hour

and was engulfed by fire for 0.5 hour. The consequences of this accident–1,300 person-rem or 0.67 latent cancer fatality–are presented in Section J.1.4.2 of the EIS. The consequences for an event in which the commercial airliner impacted a legal-weight truck cask would be about the same–1,100 person rem or 0.57 latent cancer fatality. A truck cask event that would have similar consequences would involve impact into a hard rock surface at a speed greater than 190 kilometers (120 miles) per hour followed by an engulfing fire for up to 0.5 hour.

8.10 (12193)
Comment - EIS000096 / 0006
Fourth, the Draft EIS underestimates the consequences of severe accidents and terrorist/sabotage incidents involving HHT [heavy-haul truck] shipments through Tonopah, Goldfield, and Beatty. The close proximity of the highway to hotels, casinos, retail businesses, schools, churches, and residences would increase human health effects in the event of an accident or incident involving loss of cask containment or shielding. Proximity to the route would increase the economic consequences of a HHT accident or incident, even one involving no loss of cask integrity.

Response
While a specific analysis of a severe accident or terrorist attack in the vicinity of Tonopah, Goldfield, and Beatty was not conducted, maximum reasonably foreseeable accidents were analyzed for national transportation. These results are reported in Section 6.2.4.2 and Appendix J of the EIS. The EIS analysis assumed that an accident determined to be reasonably foreseeable for national transportation could occur in Nevada with similar results. The consequences in both urbanized and rural areas were considered in determining the maximum reasonably foreseeable accident impacts.

8.10 (12262)
Comment - EIS001888 / 0598
The DEIS indicates that the DOE prepared a description of the Maximum Reasonably Foreseeable Accident (MRFA) that describes the most severe accident liable to occur to a cask being transported from a reactor to Yucca Mountain. However, none of that information is provided in the DEIS. Emergency management impacts are a critical component of the EIS. The DEIS must provide an unambiguous description of the Maximum Reasonably Foreseeable Accident as well as the likely continuum of lesser accidents that may require local emergency response assets.

Response
Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). DOE has concluded that the models used for analysis in the Draft EIS relied on assumptions about spent nuclear fuel and cask response to accident conditions that caused an overestimation of the resulting impacts. Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there could be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Figure J-9 of the EIS provides a description of transportation accidents in terms of cask temperature and impact speed. Section J.1.4.2.1 presents consequences for accidents that could release radioactive materials.

8.10 (12419)
Comment - EIS001888 / 0558
[Clark County summary of comments it has received from the public.]

Commenters stated that a full range of transportation accidents, especially low probability/high consequence accidents should be evaluated in the EIS. Other commentators stated that the EIS should evaluate a severe, but credible, transportation accident. Some commenters offered specific transportation accidents for analysis.

Response
The transportation accident risk analysis in the EIS encompasses the full range of transportation accidents. As noted in the comment, several commenters requested analysis of specific accident scenarios, such as a crash between a

railcar and a herd of cattle, a crash involving two trucks, a crash involving a truck and a train, etc. The accident analysis referred to such events as "initiating events." A large number of specific initiating events can be identified by review of historic transportation accidents or by the imagination.

Regardless of the specific initiating event, the severity of a transportation accident can be characterized by the combination of mechanical forces and heat involved in the accident. Mechanical forces account for the severity of the crash itself, while heat accounts for the severity of fire that might be involved. The risk model used in the EIS evaluated the full range of transportation accidents based on the severity of the mechanical forces and heat. Figure J-9 of the EIS shows the range of transportation accidents based on this model. An initiating event can be characterized in terms of its mechanical forces and heat, and then according to the matrix shown in Figures J-9. As a consequence, it is not necessary to analyze every possible initiating event individually because the range of accidents encompasses all credible initiating events.

Because of the rigorous design standards for shipping casks, most accidents (more than 99 percent) would not generate forces capable of causing functional damage to the cask. Therefore, most accidents would have no radiological consequences. Although it is not likely that an accident would result in functional damage to the cask and a release of radioactivity, the EIS evaluates the consequences of such an accident if it occurred. For example, Table 6-14 lists estimated impacts of the maximum reasonably foreseeable accident for truck transportation. The highest consequences would occur in an urbanized area resulting in about five latent cancer fatalities. The likelihood of such an accident is very small, about 2 in 10 million years.

8.10 (12734)
Comment - EIS001873 / 0060
P. 6-2. The statistical presentation in this section on the incident-free and accident scenario impacts of transporting high-level waste nationally and in Nevada is probably incomprehensible to the average resident of, say, Caliente, Nevada. This chapter should be rewritten in plain English. The various tables in this section alternate between expressing risk in terms of individual doses, collective doses, numbers of cancer deaths, and probabilities of cancer death. While the information appears fairly complete, the tables are not presented in a logical order that allows the risk of the various alternatives to be compared.

This kind of statistical approach, absorbing definite risk to actual people in large, vaguely defined population numbers results in statements which are simply not credible to an ordinary person.

By analogy, it is not considered safe by anyone to discharge a shotgun on the streets of a city of a million people, even though the statistical probability that a particular individual will be hurt may be negligible. To continue the analogy, if someone were actually proposing to fire the gun anyway, it would be important to know on which street and whether it would be pointed horizontally or vertically. The DEIS totally avoids the question of who is being targeted for potentially deadly radiation bombardment. The DEIS also ignores the fact that individuals in some communities will receive a significantly higher exposure. For example residents of communities on a transportation route in Nevada, Utah, or Arizona will likely be exposed to more shipments than people on a route in California or New England.

Response
DOE believes that the EIS adequately analyzes the environmental impacts that could result from the Proposed Action. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

For the reasons discussed above, DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada.

8.10 (12895)
Comment - EIS010314 / 0003
Of particular concern would be a collision that would result in a long-duration (longer than 30 minutes), high-temperature (hotter than 1475°) fire. Or a head-on or sideways collision that would result in a puncture of the cask.

Response
The Type B shipping casks DOE would use to transport spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository would be designed to withstand severe hypothetical accident conditions. The hypothetical accident conditions are described in Nuclear Regulatory Commission regulations (see 10 CFR 71.73), and include free drop, puncture, thermal, and immersion conditions. These tests are intended to simulate the effects of severe impact and long-duration fires on the shipping cask.

In the analysis of accidents, long-duration fires or punctures of the cask leading to damage and functional failure of a spent nuclear fuel shipping cask are termed "initiating events." A large number of specific initiating events can be identified by review of historic transportation accidents or by the imagination. These include collisions with fixed objects (bridge abutments, walls, barriers, etc.), collisions with other vehicles and animals, rollovers, jackknifes, derailments, and collisions at grade crossings. Any initiating event can be characterized in terms of its mechanical forces and heat, and the event can then be categorized according to the matrix shown in Figure J-9 of the EIS, which is the transportation accident risk model used in the EIS. DOE took this model from a recent Nuclear Regulatory Commission study, *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). As a consequence, it is not necessary to analyze every possible initiating event individually because the range of accidents included in the document encompasses all credible initiating events. Regardless of the specific initiating event, the severity of a transportation accident can be characterized by the combination of mechanical forces and heat involved in the accident. Mechanical forces account for the severity of the crash itself, while heat accounts for the severity of fire that might be involved in the accident. The Nuclear Regulatory Commission concludes that only a tiny fraction of all accidents, less than 1 in 10,000, would be severe enough to cause a spent nuclear fuel shipping cask to fail (Sprung et al. 2000). The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. This study reaffirmed that the spent nuclear fuel transportation regulations provide adequate protection of public health and safety.

8.10 (12896)
Comment - EIS010314 / 0004
Taking note of the fact that seventy-six commercial nuclear power reactors are currently operating to the east of the Mississippi River (and twenty-seven to the west), it would be highly plausible that a train or truck carrying spent fuel could derail on a Mississippi River bridge, resulting in the fuel cask's underwater submersion in the river. Or perhaps there could be an accident on a bridge over the Missouri, Meramec or other river in our state. Having watched the problems that faced the large crew of emergency workers here in St. Louis County (Webster Groves) when 14 coal cars derailed and dumped their freight on May 31, I absolutely cannot imagine how an immersed spent fuel cask could be removed from the river after falling from one of our high, heavily traveled bridges. It would seem that enough water in leakage could occur to make the fissile material in the cask subject to a criticality accident. (I would refer you to the Code of Federal Regulations, Title 10, Part 51 -- Section 52 (Table S-4) and Part 71 regarding the packaging and transport of radioactive materials.)

Response
As discussed in Appendixes J and M of the EIS, most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not be likely to result in release of radioactive materials from the shipping casks. Spent nuclear fuel casks are much more robust than the coal cars. If a spent nuclear fuel rail cask had been on the train that derailed and crashed into the river, the accident conditions would not have been more severe than the design standards for the cask. No release of radioactive materials from the cask would have been expected. The performance standards for the casks prescribed by the Nuclear Regulatory Commission were selected to ensure that the chance that a real-world accident would result in loss of cask integrity and release of radioactivity from the cask is extremely remote. These standards ensure that the casks would be extremely robust.

Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has

resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there could be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low.

8.10.1 SABOTAGE

8.10.1 (62)
Comment - 16 comments summarized
A number of commenters expressed concern over terrorism and sabotage against shipments of spent nuclear fuel and high-level radioactive waste. Commenters summarized the State of Nevada's petition to the Nuclear Regulatory Commission to modify 10 CFR Part 73 to increase the level of security for these shipments. One commenter noted that neither the Draft EIS nor the supporting Sandia National Laboratories report acknowledges Nevada's petition for rulemaking. The commenters asked if spent nuclear fuel and high-level radioactive waste shipments would have armed escorts along the entire shipment route rather than just while they were in urban or high-population areas. The commenters recommended that armed escorts be required for the entire route and that DOE go beyond Commission regulations that prescribe safeguards for fuel shipments. Several commenters mentioned the shipment of plutonium and commented that this material would be a particularly attractive target for terrorists.

Response
Nuclear Regulatory Commission regulations (10 CFR Part 73) prescribe safeguards and security measures for spent nuclear fuel shipments. These measures are required to reduce the likelihood of a successful sabotage attack. DOE shipments to a repository would comply with these safeguards and security regulations.

Regulations in 10 CFR Part 73 require armed guards in heavily populated areas. Escorts, but not armed guards, are required in areas not considered heavily populated. The State of Nevada's petition to the Nuclear Regulatory Commission (PRM-73-10) requests that such a distinction based on population density be eliminated from the regulations. DOE is aware of the petition and, in its January 27, 2000, comments to the Commission, expressed the opinion that the current performance-based regulations are more than sufficient to permit consideration of all appropriate threat scenarios. However, if the regulations for safeguards and security measures that apply to spent nuclear fuel transportation were revised, DOE would comply with the revised regulations for shipments to a repository. Similarly, for shipments other than spent nuclear fuel, which are addressed in 10 CFR 73.37, DOE would comply with all applicable Nuclear Regulatory Commission safeguards and security requirements.

Recent terrorist attacks have involved high-profile symbols of the United States and produced a large number of immediate fatalities. Sabotage of a spent nuclear fuel shipment would not achieve this result. Even a successful sabotage attempt would not likely release significant quantities of radioactive materials. Casks would be designed and built to prevent release of their contents in all but the most severe accidents.

8.10.1 (133)
Comment - 40 comments summarized
Several commenters expressed concern that the shipments of spent nuclear fuel and high-level radioactive waste would present an attractive target for saboteurs and terrorist actions. Media stories related to terrorism events frequently were cited for the concern. In addition, the fact that shipments would be frequent and would involve a known destination is seen as suggesting that they would be an attractive target. Commenters questioned protecting shipments at stopping points in the transportation cycle. The assertion was made that protection is likely to be inadequate compared to in-transit safeguards. Specifically, commenters stated that the Draft EIS does not address potential acts of sabotage at intermodal transfer stations. Concern was expressed about the increased risk of sabotage in Utah because of the large number of shipments going through the state and the Private Fuel Storage facility proposed in Skull Valley. In addition, one commenter requested DOE maintain efforts to test the latest potential sabotage devices against casks.

Response
Recent terrorist attacks have involved high-profile symbols of the United States and produced a number of immediate fatalities. Sabotage of a spent nuclear fuel shipment would not achieve this result. Even a successful sabotage attempt would not be likely to release significant quantities of radioactive materials. Nevertheless, the

Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection and safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the physical protection and safeguards regulation are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. The cask safety features that provide containment, shielding, and thermal protection also provide protection against sabotage. The casks would be massive. The spent nuclear fuel in a cask would typically be only about 10 percent of the gross weight; the remaining 90 percent would be shielding and structure. Additional information on the physical protection of spent nuclear fuel and high-level radioactive waste during transportation can be found in Section M.7 of the EIS.

It is not possible to predict whether sabotage events would occur, and if they did the nature of such events, nevertheless, DOE examined various accidents, including an aircraft crash into a transportation cask. The consequences of both the maximum reasonably foreseeable accident and the aircraft crash are presented in the EIS for the mostly truck and mostly rail transportation scenarios and can provide an approximation of the types of consequences that could occur from a sabotage event. In addition, DOE analyzed the potential consequences of sabotage on a truck or rail cask (see Section 6.2.4.2.3 of the EIS). The results of this analysis indicate that the risk of the maximally exposed individual incurring a fatal cancer would increase from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the terrorist attack of September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

As suggested in some comments, some types of anti-armor weapons can penetrate a cask (as shown in Section 6.2.4.2.3 of the EIS), but it should not be assumed that an attack would be easy or that a significant release would result even if a cask was penetrated. Sandia National Laboratories conducted an analysis that estimated maximum releases of radioactive material from the action of a high-energy density device when used against a shipping cask containing spent nuclear fuel (DIRS 104918-Luna, Neuhauser, and Vigil 1999). The devices evaluated by Sandia for analysis were chosen because they represent devices that are potentially available, could be carried by a person, and are highly effective at producing damage for their device category. The results of potential sabotage are discussed in Section 6.2.4.2.3.

8.10.1 (166)
Comment - 20 comments summarized
A number of comments reflected a disbelief of the Draft EIS projected sabotage consequence saying it was at least a factor of 10 too small. The commenters traced this underestimate to a recent Sandia study (DIRS 104918-Luna, Neuhauser, and Vigil 1999). The critique of the Sandia study centered on a number of aspects of the analysis which include failure to consider multiple devices, incendiary devices, modern attack devices, commercial devices or modern military anti-armor weapons. Other criticism included failure to assume full penetration, use of the "swept volume" method, failure to consider fuel oxidation, lack of testing, the use of the SCAP computer program for penetration prediction, and the use of RADTRAN and RISKIND for risk and consequence analysis. A commenter stated that the Draft EIS is silent on any impacts other than human health effects from sabotage.

Response
The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection and safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the physical protection and safeguards regulation are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. The cask safety features that provide containment, shielding, and thermal protection also provide protection against sabotage. The casks would be massive. The spent nuclear fuel in a cask would typically be only about 10 percent of the gross weight; the remaining 90 percent would be shielding and structure. Additional information on the physical protection of spent nuclear fuel and high-level radioactive waste during transportation can be found in Section M.7 of the EIS.

It is not possible to predict whether sabotage events would occur, and if they did the nature of such events, nevertheless, DOE examined various accidents, including an aircraft crash into a transportation cask. The consequences of both the maximum reasonably foreseeable accident and the aircraft crash are presented in the EIS for the mostly truck and mostly rail transportation scenarios and can provide an approximation of the types of consequences that could occur from a sabotage event. In addition, DOE analyzed the potential consequences of sabotage on a truck or rail cask (see Section 6.2.4.2.3 of the EIS). The results of this analysis indicate that the risk of the maximally exposed individual incurring a fatal cancer would increase from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the terrorist attack of September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

The Sandia analysis estimated maximum releases of radioactive material from sabotage against a shipping cask containing spent nuclear fuel. Sandia considered 15 devices and chose two for detailed analyses. Incendiary devices, which are most effective when there are combustibles present, were not considered because there would be no combustibles in a cask. Therefore, the effect of an incendiary device on a cask or its contents would be small compared to an initial release caused by the action of a high-energy density device. Fuel oxidation was not considered as a mechanism to create more particulates for release because it takes considerable time to occur and would not be a contributor to the direct release of spent nuclear fuel materials.

The Sandia scientists used the SCAP computer program, which has been benchmarked against experiments for estimating depth of penetration produced by the action of high-energy density devices. As indicated in the Sandia report (DIRS 104918-Luna, Neuhauser, and Vigil 1999), SCAP was tested against several experiments involving device interactions with material configurations not unlike spent nuclear fuel casks. Although the SCAP program's ability to estimate the depth of penetration through dense materials was demonstrated by benchmarks, the program underestimates the volumes of materials that would be destroyed by the action of a high-energy density device. Recognizing this, Sandia scientists developed a method for correcting the estimates provided by SCAP of destructed, or swept, volume. Although incorrectly described in an equation in the analysis report, swept volume was explicitly defined in the Sandia analysis.

DOE used the RISKIND computer program and the results of the Sandia analysis to estimate the human health consequences of releases of radioactive materials that could result from an act of sabotage. The RISKIND code has been used widely and is generally accepted as appropriate for estimating the consequences of radioactive material transportation accidents that could release radioactive materials. Releases of radioactive materials in a sabotage event would be comparable to releases in maximum reasonably foreseeable accidents analyzed in the EIS using RISKIND. DOE did not use the RADTRAN computer program in estimating consequences of an act of sabotage.

DOE believes the analysis provides realistic, but conservative, estimates of releases of radioactive material that could result from sabotage against a cask transporting spent nuclear fuel, and the consequences of these releases.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $9.4 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

8.10.1 (167)
Comment - 4 comments summarized
Several commenters stated that, based on state policy, law enforcement agencies would provide armed escorts while the spent nuclear fuel and high-level radioactive waste shipments were within the state's boundaries. The commenters questioned who would pay for the escorts and emergency management equipment. The commenters

stated that the costs of security measures should have been delineated, along with the responsible parties, in the EIS. One commenter asked for the definition of "heavy-populated" areas in the context of armed security requirements.

Response
DOE would comply with the Nuclear Regulatory Commission safeguards requirements in place at the time of the shipments. The costs associated with meeting the safeguards requirements, including those for escorts, would be borne by DOE. If states or tribes determined that they wished to provide escorts in addition to those provided by DOE, the cost of these additional escorts would have to be borne by the state or tribe. As stated in the EIS, armed escorts would be required in heavily populated areas. A heavily populated area is defined by the Nuclear Regulatory Commission as follows: "Certain areas within United States territory are designated as heavily populated for the purposes of regulation of spent nuclear fuel shipments. Heavily populated areas are characterized in terms of urbanized areas, as defined by the Bureau of the Census, having total populations of one hundred thousand persons or more" (DIRS 154766-NRC 1980). Response to an emergency that could occur involving a shipment of spent nuclear fuel would come initially from local response personnel, as it would for a shipment of any other commodity.

In response to public comments, DOE added Appendix M to the EIS, which describes Section 180(c) of the NWPA (see Section M.6). Section 180(c) requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. The training would cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations. DOE would provide the assistance based on the training needs of the states and tribes, as they determined using a planning grant and based on availability of funds in annual Program budgets specified by Congress. Additional Federal response capabilities, such as expert services from the Radiological Assistance Program Team, could be activated, as requested by states and tribes. The schedule in the proposed policy and procedures for implementation of Section 180(c) of the NWPA is designed to provide adequate time for training of first responders in advance of the first shipments. If there was a decision to proceed with the development of a repository at Yucca Mountain, shipping routes would be identified at least 4 years before shipments began and Section 180(c) assistance would be made available approximately 4 years prior to shipments through a jurisdiction. DOE published a Notice of Revised Proposed Policy and Procedures (63 *FR* 23753, April 30, 1998) that sets forth the proposed mechanisms for implementing the requirements of Section 180(c). As part of this program, eligible jurisdictions would receive a one-time planning grant to assess their training needs. In accordance with the Draft Policy and Procedures, jurisdictions may use a certain percentage of their financial assistance to purchase equipment that can be used for training and for emergency response.

8.10.1 (1028)
Comment - EIS000209 / 0003
At present time, Nevada believes the DEIS sabotage analysis before the end of the formal comment period. The [A] Sandia report significantly underestimates the amount of spent nuclear fuel released from the cask(s) and they may also underestimate the fraction of the release, which is a respirable aerosol. The DEIS failed to consider any impacts other than direct human health effects. Nevada will also evaluate the adequacy of the RISKIND model for this type of analysis, particularly RISKIND's ability to accurately simulate near field (within 100 to 1,000 meters of the attack site) particulate dispersal and deposition, with and without fire effects.

Response
The Sandia report (DIRS 104918-Luna, Neuhauser, and Vigil 1999) estimated the average and maximum releases of radioactive material from sabotage against a shipping cask containing spent nuclear fuel. Luna, Neuhauser, and Vigil considered 15 devices and chose two for detailed analyses. Incendiary devices, which are most effective when there are combustibles present, were not considered because there are no combustibles within a cask. Therefore, the effect of an incendiary device on a cask or its contents would be small compared to an initial release caused by the action of a high-energy density device.

The SCAP computer code was used to estimate the depth of penetration produced by the action of the high-energy-density-devices. SCAP was benchmarked against several experiments involving device interactions with material configurations not unlike spent nuclear fuel casks (DIRS 104918-Luna, Neuhauser, and Vigil 1999).

DOE used the RISKIND computer code and the results from Luna, Neuhauser, and Vigil (DIRS 101836-1999) to estimate the human health consequences of releases of radioactive materials that might result from an act of sabotage. The RISKIND computer code has been used widely and is generally accepted within the health physics community as appropriate for estimating the consequences of radioactive material transportation accidents that could release radioactive materials. Releases of radioactive materials in a sabotage event would be comparable to releases in maximum reasonably foreseeable accidents analyzed in the EIS using RISKIND. DOE did not use the RADTRAN computer program in estimating consequences of an act of sabotage.

DOE believes the EIS analysis provides realistic, but conservative, estimates of releases of radioactive material that could result from sabotage against a cask transporting spent nuclear fuel or high-level radioactive waste, and the consequences of these releases.

The EIS uses the risk of a latent cancer fatality as its primary measure of radiological impact. However, other radiation-related impacts such as the incidence of nonfatal cancers and severe genetic effects are discussed in Section F.1.1.5 of the EIS. All radiation effects are linear with latent cancer fatalities and including these other radiation-related impacts would increase the total detriment from radiation exposures by about 50 percent.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. Section J.1.4.2.5 discusses ecological restoration after a release of radioactive material.

8.10.1 (1035)
Comment - EIS000209 / 0005
Increased vulnerability of shipping casks results from changes in the capabilities and availability of high-energy explosive devices and from changes in cask designs. Portable antitank weapons have become more powerful, more reliable, and more available worldwide since the early1980s. Many of these weapons are capable of penetrating 20 to 40 inches of armor plate steel. Commercial shaped charges and detonation systems developed for applications in the construction and petroleum industries are widely available. Numerous “off the shelf” military and commercial shaped charges weighing around one kilogram are capable of penetrating 10 to 20 inches of steel. It is probable that even more powerful and efficient explosives will become available during the next four decades when repository shipments are under way.

The new shipping casks assumed in the DEIS appear to be highly vulnerable to attacks using currently available high-energy explosive devices. The new General Atomics GA-4 and GA-9 legal-weight truck casks have a side-to-side width of 35 to 37 inches, with walls containing about 2 inches of stainless steel and 2.6 inches of depleted uranium. The DEIS provides less specific details about the new rail cask designs. The largest new rail casks will likely have designs similar to the Nuclear Assurance Corporation NAC-TSC, the Holtec HI-STAR 100, or DOE large MPC Rail Transporter. These casks have diameters of 85 to 96 inches, with walls containing 4 to 7 inches of stainless steel and 2 to 4 inches of carbon steel or lead and depleted uranium.

Response
Luna, Neuhauser, and Vigil (DIRS 104918-1999) estimated the average and maximum releases of radioactive material from the action of sabotage against a shipping cask containing spent nuclear fuel. Luna, Neuhauser, and Vigil considered 15 devices and chose two for detailed analyses. Incendiary devices, which are most effective when there are combustibles present, were not considered because there are no combustibles within a cask. See Section 6.2.4.2.3 of the EIS for additional information.

8.10.1 (1773)
Comment - EIS000605 / 0001
Now item 1, security. Nowhere have I seen any document stating truck drivers and railroad personnel are required to have [a] special government clearance. Not in the RFP, request for proposal draft dated 1998, nor in the EIS or even in the DOT regulations.

Actually, imagine 70,000 tons of high level nuclear hazardous waste has arrived at Yucca Mountain. The entire world has been watching and waiting. After all, we are making history. Various tragedies have occurred as this material traveled through 43 states to its final destination.

According to Volume 1, paragraph 1.2.4, 55 tons of weapons usable plutonium has arrived. According to geologist John T. Rosenthal, he works for [Booz] Allen and Hamilton, he says about security:

"If Yucca Mountain becomes a high level waste storage site, Energy Department plans call for either closing it up as early as 10 years after the last waste canisters are buried, or keeping it open for hundreds of years. If the Department elects to close the mountain it would seal all the shafts, ramps, exploratory bore holes and other underground openings to further discourage any intruders."

We're like a bunch of idiots here.

"Permanent warning markers and monuments would be put up around the site."

Now this is what Rosenthal says.

"The Department is not worried about sabotage. In its recent Environmental Impact Statement, it says that the site's remote location and the area's low population density makes it an unattractive target. In addition, it tends to have extra security measures in place. At one of the alcoves a fixed spaghetti of cable snakes from the walls to an array of sophisticated monitoring equipment and electronic board the size of a large screen TV records the total power used, as well as the total power cost and the current rock temperature."

Now, my final statement. Hypothetically, 70,000 tons -- did I read this already? Okay. Now please close your eyes just for two minutes and imagine, 75 to a hundred miles away, nowhere near the security measures referred to by John Rosenthal. Instead, John Q. Tourist trained by Kadafy is about to launch one missile using his sophisticated electronic equipment. Or this same scenario could happen somewhere on route to Yucca Mountain.

Response
The EIS discusses sabotage during transportation in Section 6.2.4.2.3. Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (1922)
Comment - EIS000477 / 0002
Another issue I have is the transportation of the waste. If as the DOE studies demonstrate, an accident during the shipment process (1:343 ratio) happens in a populated area, who will accept personal responsibility, you? I've seen the infocommercials back in 1991 showing a locomotive smashing into the stainless steel waste container -- I wasn't convinced. If the waste travels by rail, it makes sense that it will pass through the heart of Las Vegas and North Las Vegas, not to mention Nellis Air Force Base. What additional safeguards are being discussed to prevent any accidental leakage of radioactivity. It would be very easy for local governments or individuals to block rail routes. Remember the Shoshone-Bannock Tribe in Fort Hall, Idaho, using their police force to prevent a nuclear shipment in 1995? What if a terrorist group did that? How secure are these shipments going to be?

Response
The safety and security of spent nuclear fuel shipments is the responsibility of DOE. DOE would ensure that the contractors making the shipments followed DOE and Nuclear Regulatory Commission safeguards requirements. In response to comments, additional information on safeguards requirements is included in Section M.7 of the EIS.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

8.10.1 (2718)
Comment - EIS000440 / 0001
But, today we address the vulnerability of repository shipments to terrorism and sabotage, specifically the consequences of attacks on shipping cask utilizing high-energy explosive devices. You are not going to hear much applause from the State of Nevada for the Draft EIS by the DOE, but there is one issue on which we will applaud them this morning, and that is their decision to address the issues of terrorism and the consequences of sabotage, radiologic sabotage, forthrightly in this document.

We're heartened to see that for the first time in the 20 years that I have been reviewing Department of Energy EIS there's at least a willingness on their part to acknowledge the vulnerability of shipping casks to such attacks.

Response
The EIS discusses sabotage during transportation in Section 6.2.4.2.3. Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (2732)
Comment - EIS000709 / 0006
The DOE, in No Action Scenario 1, states that storage at the present sites has the disadvantage of increased risks of sabotage and materials diversion. They do not, however, use that same reasoning when it comes to the 49,500 shipments from across the country to Yucca Mountain. Even without detailed analysis, it is obvious that a shipment of radioactive material, even under military guard, is much more vulnerable to attack than that same material in a secured storage area within a secured nuclear power facility.

Response
The EIS discusses sabotage during transportation in Section 6.2.4.2.3. Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (3251)
Comment - EIS000949 / 0002
On transportation, a terrorist attack on high level nuclear waste carriers is potentially the most serious. The federal government should fund engineers during the next ten to twenty years to design the protective shipping containers to withstand any terrorist attack, including bombing the trucks and trains with high explosive bombs. The Department of Energy must assure us that the containers will not break open and let nuclear waste escape, even in the worst conditions. It is further suggested that sabotage and terrorism should be addressed in the Nuclear Regulatory Commission design study that is responsive to these concerns.

Response
Cask safety features that provide containment, shielding, and thermal protection also provide protection against sabotage. The casks would be massive. The spent nuclear fuel in a cask would typically be only about 10 percent of the gross weight; the remaining 90 percent would be shielding and structure.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (3437)
Comment - EIS000973 / 0001
I would like to know the explosive power in TNT [tri-nitro toluene, or dynamite] units that a [cask] carrying nuclear waste can tolerate.

Response
The details of the results of specific tests related to sabotage of spent nuclear fuel casks are not provided in public documents such as this EIS.

8.10.1 (3645)
Comment - EIS000816 / 0002
No type of packaging will be entirely safe from structural damage if an accident or an event involving an act of sabotage occurs. Each of these scenarios foresees breach of cask and an insuring radiation release. Depending on type of material being transported and location of the release, this could result in not only immediate and numerous losses of life, but latent ongoing health concerns and unspecified danger for the immediate environment and all its inhabitants in perpetuity.

Response
Cask safety features that provide containment, shielding, and thermal protection also provide protection against sabotage. The casks would be massive. The spent nuclear fuel in a cask would typically be only about 10 percent of the gross weight; the remaining 90 percent would be shielding and structure.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (3700)
Comment - EIS000980 / 0002
How about sabotage or terrorist attacks? Terrorist would love to steal our plutonium to manufacture their own bombs. Or they might just want to demand millions of dollars or other terrorist" release from jail in exchange for not blowing up a high-level radioactive waste transport. With such frequency of shipment, it couldn't be too hard for terrorists to figure out when and where these materials are enroute. If a bomb landed on one of these vehicles, or a suicide bomber decided to ram one, we're talking about life-threatening pollution, not just to the surrounding area, but to the entire city. In the DOE's Draft Summary Environmental Impact Statement, in a chart of Estimated National Transportation Impacts for 24 years of operations (p. S-53), latent cancer fatalities from maximum reasonably foreseeable accidents are 5 for mostly truck scenarios and 31 for mostly rail scenarios. These estimates could not possibly have included potential terrorist attacks. Apparently, there is some concern about such attacks, as the Nuclear Regulatory Commission will require two armed escorts for every shipment of irradiated fuel rods. Such guards might have been able to save the stagecoaches of days past, but I have little hope that they could overpower modern terrorists.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (4054)
Comment - EIS001474 / 0004
The question of terrorism as a danger for these shipments, it's been said that these shipments are not. If you listen to the Department of Energy and as well to the Nuclear Regulatory Commission, these shipments are very safe, nothing could ever go wrong with these shipments. But they contain some of the deadliest materials on earth. If they're breached and the materials are released into the environment, that is a catastrophe to that local environment. And it's very difficult to clean up radionuclides that get into the environment, and Chernobyl shows that. A huge percentage of the national budget of the countries over there is being devoted to Chernobyl cleanup. And right at the reactor itself, which was the showcase of the cleanup efforts, the readings are still very high right there. So it's very difficult to clean the stuff up once it gets out.

And it's interesting that we just had a court case in Kalamazoo where we were trying to get an injunction against a Department of Energy shipment of plutonium experimental fuel through Michigan, and we had a person who's worked for the State of Nevada who's done reports of danger of terrorism to high-level waste shipments, and he was one of the expert witnesses who testified that this plutonium shipment was a high-profile federal project, that there was concern, and that it hadn't been addressed by the Department of Energy in its environmental assessment for that project.

And one of the arguments that the U.S. attorneys representing the Department of Energy made was that this single shipment of plutonium was not equal to Yucca Mountain and all those shipments, so how could we ask the judge to put an injunction on this one shipment when Yucca Mountain just dwarfed it.

So I thought that was really interesting that that argument was floated. And I imagine they didn't think that anybody involved with Yucca Mountain would ever hear those words. So it was an admission that terrorism is a significant situation that wasn't addressed adequately at all in this document.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health.

The EIS discusses sabotage in Section 6.2.4.2.3. Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. Section J.1.4.2.5 discusses ecological restoration after a release of radioactive material.

8.10.1 (4331)
Comment - EIS001209 / 0002
The Commonwealth of Virginia also reviewed the *Federal Register* Notice published by the Nuclear Regulatory Commission pertaining to a petition filed by the State of Nevada to amend NRC's [Nuclear Regulatory Commission's] regulations governing safeguards for shipment of spent nuclear fuel against sabotage and terrorism. As stated in our November 29, 1999 response to the NRC, Virginia is supportive of any precautionary measures, which serve to protect its citizens, environment, and natural resources against potential danger associated with spent nuclear fuel shipment and storage. Therefore, the Department of Emergency Services, Brian Iverson at (804) 674-2400, and the appropriate localities should be notified prior to the transportation of hazardous materials from or through Virginia. Also, we agree with the recommendation of reviewers that a periodic review of threat levels and an evaluation of tactical response measures may be appropriate.

Response
DOE would follow the Nuclear Regulatory Commission requirements on prenotification in effect at the time of shipment. Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (4427)
Comment - EIS000992 / 0002
One specific issue that has been raised in recent years by those in opposition to nuclear power is terrorist assault or acts of sabotage directed against used nuclear fuel and high-level radioactive waste shipments. Although this country has been sensitized to the terrorist potential ever since the World Trade Center bombing, I am convinced that used nuclear fuel and high-level waste shipments are a remote target for such acts. Having said that, if for some rare reason a shipment might be singled out for assault I am confident that the design basis of the package (cask) and the nature of the contained radioactive material would make the attack either unsuccessful or in the worst case a limited, manageable event. Clearly not one postulated by the preposterous "Mobile Chernobyl" term that the anti-nuclear factions have incorrectly used to characterize the shipping of these materials.

From the design point of view, the Federally mandated accident conditions bound the conditions that would be expected in an assault such as those in Oklahoma City, New York City, Atlanta, and a few other locations. These have been "homemade" large explosive devices that are effective against structures such as buildings, or against people. However, the blast effects and even the objects propelled by such blasts may dislocate a cask and its transporter (e.g., overturn) but in my judgment are bounded by the design conditions for the package. That is, package integrity will be maintained.

Our opponents cite high-energy weapons such as anti-tank missiles as having the ability to penetrate a cask wall. I cannot quarrel with this, since such was demonstrated by the NRC [Nuclear Regulatory Commission] and the DOE in the 70's and 80's in a comprehensive testing program. [It is worth noting that there have been no terrorist assaults in this country where such weaponry has been used.] But the significance of the earlier testing program and the update of that program performed by Sandia in support of the YMP [Yucca Mountain Project]/EIS (SAND99-0963) is that even with a penetration of the cask the amount of material released is a small fraction of the total cask contents. Estimates range from 0.0003% to 0.01% depending on the size of the cask. Of this amount roughly 0.5% of it is estimated to be of aerosol size capable of being dispersed beyond the immediate vicinity. Regardless of cask size, this is a small amount of material. It will result in a highly localized contamination event with limited effects outside the immediate area. Both are quite manageable.

Of course the radiological consequences, as manageable as they are projected to be, can only occur if one accepts the assertion of the anti-nuclear activists that these shipments are a likely target. I am convinced that just the opposite is true.

Those dedicated to terrorism are making a statement through their acts. Such a statement demands a successful outcome of the assault, something that is highly unlikely when used nuclear fuel or high-level radioactive waste shipments are the target. Indeed, a failed attempt is essentially a confirmation of the safety that is inherent in the cask design and the shipment of these commodities, a strong deterrent in itself. There are many factors that make attempts likely to fail.

Initially, there are Federal regulations in 10 CFR 73 that address in-transit security. These speak to the security of shipping information, transport personnel qualifications, escort requirements, communications requirements, and transportation equipment features. Shipments will be continuously tracked via satellite thus assuring constant monitoring of shipment parameters.

Additionally, there is the issue of a successful assault. As stated previously, a large explosive device is not going to be successful in disrupting cask integrity, even though it may result in dislocation of the transport system. An attack using some form of high-energy penetrating weapon has a number of associated problems as outlined in the recent Sandia report. These include: weapon portability, training, targeting, weapon functioning, cask construction features, transporter speed, and meteorological conditions. These all contribute to the high likelihood of an unsuccessful attempt.

Realistically there are countless targets through which a terrorist can make a statement with reasonable confidence of a successful assault. A used nuclear fuel or high-level radioactive waste shipment, in my opinion, is not one of them. Even an anti-nuclear terrorist would select a target with greater assurance of success.

Federal regulations and the planned operations of the transportation system together with the rugged design of the shipping casks and the success uncertainty of any assault makes terrorist attacks or acts of sabotage against used fuel or high-level waste shipments extremely unlikely. And, in the event of a successful, assault, the effects are projected to be acceptable low.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

It is the Department's opinion that the EIS adequately analyzes the potential environmental impacts of spent nuclear fuel and high-level radioactive waste accidents, including sabotage.

8.10.1 (5293)
Comment - EIS000968 / 0010
The State [of Nevada] is responsible for providing for the security and safety of the proposed shipments. The DEIS dos not address minimum security requirements, proper escort staffing, or inspection of vehicles entering the State.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. More detailed information is provided in Section M.7 of the EIS.

8.10.1 (5307)
Comment - EIS001887 / 0043
The Draft underestimates the consequences of severe accidents and terrorism/sabotage incidents, especially with respect to heavy-haul transportation. The Draft EIS fails to appropriately recognize human initiated events as risk factors associated with the loading, transportation, and unloading of radioactive waste shipments. The Draft reflects an overriding "denial" philosophy that is evidenced in the lack of critical or even anecdotal discussion of sabotage and terrorism within Section 6 and Appendix J of the Draft EIS.

The Draft EIS must acknowledge the existence of credible and realistic risks from sabotage and terrorism. The symbolic value of repository shipments as targets and the regularity, frequency, and duration of shipments substantially increase the risks of human initiated events.

Spent fuel loading, transfer, and unloading activities should have been recognized as vulnerable to sabotage and terrorism attacks. These risks should have been addressed in the Draft EIS together with the implications of new regulations needed to limit the effects of human initiated events on the overall repository shipment program.

The complete point-to-point shipment process needs to be re-analyzed using updated assumptions about terrorist/ sabotage technology and more realistic expectations of the potential for sabotage and terrorism attacks. The State of Nevada has begun this process by publishing several relevant documents on target types and risks associated with potential adversaries. Recognition of these concerns and an adequate analysis of the risks associated with potential terrorism/sabotage must be incorporated within the final EIS.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear

fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. Because the heavy-haul truck implementing alternative would be like moving a rail cask on a truck, the analysis of the consequences of an accident to a rail cask is applicable. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Spent nuclear fuel loading, transfer, and unloading activities would occur in fixed facilities. These facilities would have to meet the requirements in U.S. Nuclear Regulatory Commission physical protection or safeguards regulations. For example, 10 CFR 63.21 requires a repository at Yucca Mountain to have physical protection consistent with 10 CFR 73.51. This regulation specifies a performance objective, which provides "high assurance that activities involving spent nuclear fuel and high-level radioactive waste do not constitute an unreasonable risk to public health and safety." The regulation requires that spent nuclear fuel and high-level radioactive waste be stored in a protected area such that:

- Access to the material would require passage through or penetration of two physical barriers. The outer barrier would have isolation zones on each side to facilitate observation and threat assessment, would be continually monitored, and would be protected by an active alarm system.

- Adequate illumination would be provided for observation and threat assessment.

- The area would be monitored by random patrol.

- Access would be controlled by a lock system and personnel identification would be used to limit access to authorized persons.

A trained, equipped, and qualified security force would be required to conduct surveillance, assessment, access control, and communications to ensure adequate response to any security threat. Liaison with a response force would be required to permit timely response to unauthorized entry or activities.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments and key facilities. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (5469)
Comment - EIS001660 / 0015
The DEIS inadequately provides information about terrorist/extremist threats, and used old data to provide this information. The DEIS must use current data and involve new experiments concerning modem cask response to sabotage events. The Memo to Mr. R. Halstead from "Radioactive Waste Management Associates" which has been included in Mineral County's comments for record are referenced - "2. Deficient Treatment of Sabotage". pp. 6-19, see Attachment G. [Following is text of reference.]

Deficient Treatment of Sabotage

There are a number of points of contention with the current treatment of sabotage by the DOE in the Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS-0250D, 1999) and referenced documents. In order to establish the need for a reevaluation of the analysis of sabotage used by DOE in preparation of the EIS most clearly, only the most significant problems will be addressed. The final conclusion of this section is that the

DOE does not adequately address the threat of sabotage, nor does it prove that concerns about the affects of such an event are unwarranted.

Inadequate selection of Reference Weapons and Reference Cask

The type of shaped charge used in the Sandoval experiments and cited in Luna as the device offering the maximum impact of a sabotage attack is the M3A1 military shaped charge. This charge, when tested against a full-scale GE IF-200 cask, was capable of penetrating one cask wall, penetrating 42 cm (16.5 inches) into the cask, damaging 50% of the spent fuel rods, and releasing more than 1% of the total fuel. Sandoval also says that a survey of attack devices was performed in this study, with the devices selected based on their availability to the perpetrator and their potential to breach truck casks. The details of this evaluation are classified.

In order to better understand exactly what devices were considered for possible use as the reference weapon, it is necessary to understand the restrictions placed on this analysis. In 10 CFR 73.1.a.1, "radiological sabotage" is defined as:

(i): a determined violent external assault, attack by stealth, or deceptive actions, of several persons with the following attributes, assistance, and equipment:

a. well-trained (including military) and dedicated individuals

b. inside assistance, passive or active

c. suitable weapons, up to and including hand-held automatic weapons, equipped with silencers and having effective long-range accuracy

d. hand carried equipment, including incapacitating agents and explosives for use as tools of entry or for otherwise destroying reactor, facility, transporter, or container integrity or features of the safeguard system.

e. four-wheel drive land vehicle used for transporting personnel and their hand Carried equipment to the proximity of vital areas

(ii): an internal threat of an insider, including an employee

(iii): a four-wheel drive land vehicle bomb

This provides the parameters by which the assessment of possible weapons was made. The definition of "hand Carried equipment" is unclear. It appears that such anti-tank artillery as the Milan Anti-Tank Missile and the US TOW 2 Anti- Tank missile, reported to have armor-penetrating capabilities of greater than 1000mm (39.4 inches) and greater than 700mm (28.5 inches), respectively, have not been considered as plausible sabotage weapons. In contrast, the M3A1 is reported as having armor-penetrating capabilities of at least 20 inches. This means that either of the anti-tank missiles will penetrate deeper into a spent fuel cask, likely completely through, drastically increasing the amount of material released. Anti-tank missiles of this sort must be analyzed in a credible sabotage analysis. Both devices can be transported by a few persons, or a vehicle, and thus should be considered "hand Carried."

Failure to consider arson coupled with missile strike as credible reference weapon and reference attack

A very significant factor to note when analyzing the results of the Luna report is that missile strikes accompanied by fires have not been considered. In section 3, the following statement is made:

"[U]nlike tanks and other typical targets of armor-piercing weapons, nuclear waste casks contain no explosive or combustible materials that could be touched off by the HEDD penetration, so little secondary damage is expected. In other words, only penetration and swept volume of spent fuel disrupted determine the magnitude of the damage that can be inflicted by an attack on a cask, not penetration depth per se."

This shows a hidden assumption in the assessment of sabotage. The Luna study assumes that there will be no fire coupled to a missile strike in the event of sabotage. Luna makes this assumption noting that the casks themselves are not combustible. However, this does not account for the potential of saboteurs to deliberately set a fire, or for the fact that the casks will be in proximity to combustible materials while being transported. Shipping casks are designed for transport on trucks or trains that are powered by highly flammable, combustible materials. These casks are also very likely to spend a significant portion of their travel in proximity to other trucks, rail cars, pipelines, etc. containing combustible or explosive materials. Further, potential saboteurs must be assumed to have knowledge that engulfing a target in flames in addition to striking it with a missile will be very likely to cause extensive damage. All of these factors lead to the conclusion that "secondary damage" cannot be ignored, as it has in this study.

Heat input to a cask will weaken the areal density of the metal shielding layers. If potential saboteurs were to first weaken the shipping casks via thermal input before missile strike, this could significantly increase the damage caused by such an event. In a series of experiments testing resistance of shipping containers to puncture conducted for the NRC by Lawrence Livermore National Laboratory and published in 1980, the impact of increasing temperature on cask strength was addressed (NUREG/CR-0930). One experiment in this study concentrated on the effect of temperature on the ultimate "punch force" required to completely penetrate a shipping cask wall. From this test it was determined that "the force at failure decreases with increasing temperature," (NUREG/CR0930, p. 32). This study used three temperatures for this determination: room temperature, 200°F, and 400°F. Since this study shows there is a correlation between the force required to penetrate a shipping cask wall and the temperature of the cask, it is very important that these effects be considered in a proper evaluation of sabotage scenarios. Further, the temperatures involved in deliberately set, engulfing fires will be able to raise the cask outer wall temperature to levels much beyond this range. In the Modal Study, it is commented that the rail and truck casks used in their analysis "can be exposed to a regulatory fire (1475°F, engulfing) for over 1 hour" (6-43) before the temperature at the mid-lead thickness of the cask wall reaches 500°F. ... What this statement does show is an acknowledgement that the regulatory fire will raise the temperature of a shipping cask wall over the 400°F temperature estimate used in NUREG/CR-0930. This leads to the conclusion that in extreme fire situations, such as those deliberately set as part of a sabotage attempt, the temperature of the shipping cask will rise. This will lessen the force required to completely penetrate the shipping cask wall, as was discovered in NUREG/CR-0930, resulting in greater damage to a fuel cask in the event of a subsequent missile attack.

In addition, not addressing the effects of heat input on spent fuel respirable release in the event of a breach ignores the ability of temperature to increase the percentage of spent fuel released in respirable form. For example, the conversion of $U0_2$ to U_30_8 is exothermic at slightly elevated temperatures, and results in the formation of a fine powder of respirable size (Aronson). Coupling a fire with a cask breach will expose the spent fuel inside the cask to elevated temperatures, resulting in thermodynamically favorable conditions for the above reaction. The importance of this term needs to be addressed in an assessment of sabotage consequences.

By failing to include thermal effects in its assessment of sabotage, the DOE has provided an insufficient treatment of sabotage consequences in the Yucca Mountain EIS. This needs to be remedied before the true impact of a successful event can be analyzed.

Improper extrapolation of previous experiments to current cask designs

Swept Volume

In the Luna report, it is acknowledged that the cask design used in the 1980-1981 tests examined in the Sandoval report is outdated, and an attempt is made then to correlate the data collected in these experiments to a computer simulation of a newer-design cask impact by two HEDD devices. In particular, Luna suggests an "alternative" means of analyzing the test results in the Sandoval report which "enables evaluation of the magnitude of the potential source term in other situations based on calculated hole volumes." (Luna 2.2.6)

To do this, Luna attempts to correlate the experimentally determined ratio of respirable aerosol produced to the mass of fuel released in an event to a calculated ratio based on the mass of swept fuel. The equation is (Luna 2.2.6):

MS =(π/) x NP x NL x NR x PL x PD

NP:
An estimate of the amount of fuel assumed to be affected longitudinally in the pin at the center of the hole. Assumed to be the number of pellets in the missing length rounded up to the next whole pellet. Operationally defined as L/L_p, the missing length of pin divided by the pellet length [unitless].

NL:
An estimate of the affected number of pins laterally. Assumed to be the number of pins within the hole diameter rounded up to the next integer. Operationally defined as L/PP, rounded to the next integer, giving it units of [length^2]

NR:
Defined by Luna as "number of rows of pins along the disruption path/PP," thereby giving it units of [length].

PL:
Depth of penetration of pin disruption. Operationally defined by Luna as NR/PP, giving it units of [length^2]

PD = pellet density, giving it units of [mass/length^3]

Thus according to Luna, the equation works out to be:

MS[mass] =(π/4)[unitless] x NP [unitless] x NL [length^2] x NR [length] x PL [length^2] x PD [mass/length^3],

[mass] = [mass*length^2]

The inconsistent units definitely need explanation by the Sandia researchers responsible for the report. The numerical values obtained using this equation were duplicated by independent calculations, assuming that the number of rows of pins along the disruption path was 6 for the full-scale test... This suggests that either the units are listed incorrectly in the document, or that the equation used to estimate swept mass is invalid. Until this discrepancy is addressed, the DOE's use of the Luna report in the Yucca Mountain EIS is suspect.

Even if the unit discrepancy is a mere typographical error, equating the mass of swept fuel with the respirable release fraction fails to consider such factors as number of holes of penetration (2 for full penetration) and differences in thermal properties of HEDD devices. First, it was assumed that, because the Sandoval full-scale test and the computer modeled test in Luna predicted shaped charges to penetrate only one side of a shipping container, the amount of released respirable material could be described as proportional to the "swept volume" of the fuel pins. However, it was also acknowledged that having multiple holes (for example, an exit and entry hole, or multiple entry holes caused by multiple device strikes) would significantly increase the fraction of respirable material released, since multiple holes will allow outside air to flow through the cask. Because the DOE assumes that a terrorist strike will result in only one hole into a shipping container, it is assumed that this air flow will not be generated, thus leading to the correlation between affected mass and respirable release.

However, it is necessary to consider the event of a full cask penetration (or multiplehole penetration) event. Under these circumstances, there will be a continual supply of oxygen provided to the inner core of the cask. This oxygen will then react with the uranium dioxide spent fuel, oxidizing it to U_3O_8. This process is exothermic at slightly elevated temperatures, and results in the formation of a fine powder of respirable size. Further, this air flow, when coupled with elevated temperatures resulting from fire (as would be reasonable in the event of a crash or deliberate arson) would heat the core of the cask without having to first heat its surrounding shields. This will result in a quick elevation of the spent fuel temperature, providing more oxidation and thus more respirable aerosol production. Because the DOE assumed that all sabotage events would at most penetrate a shipping cask with one hole, this mechanism was ignored.

In review of the testing performed at Sandia and Batelle laboratories in the 1980s, it is stated that the M3A1 charge used would completely penetrate certain shipping casks such as the NFS-4 (Dietrich & Walters, 1983 pg. 5). If this type of cask were used in destructive testing, the benchmark forming the basis for the Luna results could be drastically different. This shows the need to consider the effects of a complete penetration event. In the case of a complete penetration, according to the review cited above, "the entrainment of particles in the jet's wake would

enhance release at the jet exit hole. Further, two holes should vent more rapidly than one and perhaps capture higher initial concentrations in the efflux" (5). By referencing a flawed computer evaluation of cask resistance to HEDD impact, the EIS has improperly limited the discussion of impacts associated with sabotage events to single-hole, incomplete penetrations. This results in an incomplete estimate of the true effects of a successful sabotage event.

The Luna report acknowledges that the existence of multiple holes results in significant increases in aerosol release fractions. In section 2.2.5, the report states that "the total effect of a full penetration event may be to increase aerosol release by approximately 10 times the aerosol release fraction from partial penetration." If we use this factor of 10 to figure out a new % respirable release and account for the difference between spent fuel and surrogate fuel, the % respirable release is greater than 1%. Below is outlined the % respirable release fractions assuming 10x greater release than was estimated in the Sandoval tests. Also, three different spent fuel-surrogate fuel correction factors are used (see section 2.2.3) to show how they affect the results.

	Release fraction from Sandoval test	**New release fraction, assuming 10x Sandoval result**
Aerosolized fraction of surrogate fuel mass released from pins	0.000537	0.00531
% aerosolized fraction of spent fuel mass released from pins, using SRF of 3	0.1611%	1.611 %
% aerosolized fraction of spent fuel mass released from ph% using SFR of 5.6	0.300%	3.00%
% aerosolized fraction of spent fuel mass released from pins, using SFR of 12	0.644%	6.44%

More analysis needs to be performed before a swept fuel mass can be used as a correlation factor predicting masses of respirable fuel released in the event of a high-energy impact.

In using Swept Volume as a surrogate for respirable release, the analysis is making the assumption that all potential devices used in a terrorist attack will behave the same as the M3A1 charge. Its conclusion rests on the assumption that, given a certain swept volume size, a certain respirable mass fraction will be released, regardless of other factors, such as differences in thermal heat evolution. Further, the computer code used to estimate release fractions of other casks was calibrated using only two test results. When it was found that the code underestimated the hole size by a factor of two, the calibration simply multiplied by 2 to obtain a correlation. Without an, experimental validation of the ability of the SCAP code to effectively model the newer-generation casks, this approach is unacceptable.

Respirable Aerosol Production

Luna addressed a mechanism for additional respirable aerosol release due to the pressurized nature of actual spent fuel rods which was not addressed by the Sandoval tests using unpressurized rods. The report states that in the Sandoval experiments there was a "significant amount of surrogate fuel aerosol created within the cask by the HEDD that remained inside and was ultimately deposited on the inner surfaces of the cask." Some or all of the unaccounted material in the Sandoval tests (which Sandoval concluded "could not have been respirable") is likely to be made up of this material. Luna states that, given a mechanism to create flow of gas out of the cask, this could become an additional respirable aerosol source.

The Luna study addresses the fact that real fuel rods are pressurized, and that rupture of these rods allows gas to escape, producing a flow that will carry aerosol into the environment. In every test subjecting shipping casks (real or modeled) to a HEDD explosion, the fuel rods used were not pressurized, and there was never a direct measurement of the actual quantity of respirable aerosol within the cask that would comprise this contribution from "blowdown." Luna then attempts to estimate the amount of respirable material generated via this pathway by using a brittle fracture study conducted at Argonne National Laboratory (Jardine et al, 1982. "Final Report of Experimental Laboratory-Scale Brittle Fracture Studies of Glasses and Ceramics," Report No. ANL-82-39, Argonne National Laboratory, Argonne, IL.)

Jardine developed experimental data on the amount and size distribution of particulate material produced by calibrated hammer impacts on brittle materials. His work developed a linear relationship between energy density in the material from the impact of a calibrated hammer on brittle materials and the mass of particulate material with geometric diameter less than 10μM over 2 orders of magnitude in energy. Important to note is that Jardine used materials that were sufficiently refractory to ensure that melting and vaporization were not a factor. Thus, one problem with correlating this study for use in tests involving high density devices is that thermal properties are not considered. This is incorrect for missile penetrations, especially when they are coupled with fire (deliberate or otherwise).

Next, Luna takes the relationship found by Jardine for particles of 10μm geometric size and says that this analysis is not interested in these particles. Luna states that "of interest to this study is the quantity of particles that are of respirable sizes. For uranium dioxide pellets with a density of 10.5 g/cm^3, this corresponds to a geometric size of about 3μm." The use of 3μm particle size is unsubstantiated, since particles of size 10μm are airborne and will contribute to overall dose in the event of an explosion. Further, 10μm particles are generally considered the maximum size for respirable aerosols. Therefore, this is the size that should be used in determining the aerosol fraction released in sabotage tests.

Particles of size in the range of 10μm are small enough to be dispersed quite far from an implosion scene. In addition, they can be deposited in the nasal region of the respiratory tract. While it is rare that particles of this size penetrate into the lungs, they will contribute to overall radiological dose. In addition, many of the particles deposited in the nasal region will be ingested, contributing to continued dose inside of the body. Ignoring particles greater than 3μm thus leads to an underestimate of the true radiological health effects of a postulated terrorist event.

To estimate the impact energies expected from HEDD1, Luna takes the estimated HEDD1 kinetic energy and divides it by the estimated swept volume of the disrupted fuel. Luna then makes two estimates: "the highest energy represents no attenuation of the HEDD energy by penetrating the wall. Since the HEDD action penetrated about equal amounts of mass per unit area passing through the wall and passing through the fuel, the residual energy deposited in the fuel is likely to be one-half to one-third of the initial energy density. This is shown by the low end of the range indicated on the plot." In fact, the lower energy is 1/3 of the higher energy. Luna then states that the correlation, using a particle diameter of 3μm and an energy density of 1/3 the estimated initial energy density, approximates that 5% of the unaccounted mass will be respirable.

There are a number of things seriously wrong with this conclusion. First, the Jardine study that the entire relationship is based on does not take into account thermal effects when estimating the correlation between energy density and respirable aerosol production. The correlation used was obtained from a test involving a calibrated hammer, not a high-temperature explosive device. As was mentioned earlier, Luna comments that "all materials were sufficiently refractory to assure that melting and vaporization were not a factor in the tests." (22) This suggests that the correlation is leaving out the importance of temperature in creating additional respirable particles, which if included would certainly increase the fraction of respirable aerosol production.

Second, the $U0_2$ and spent fuel data points obtained from other studies (MacDougall et al, 1987. "Site Characterization Plan Conceptual Design Report, Volume 4, Appendices F-O," Report No. SAND94-2641, Sandia National Laboratories, Albuquerque, New Mexico), (Alvarez et al, 1982. "Waste Forms Response Project Correlation Testing," Report No. EGG-PR-5590, Idaho National Engineering Laboratory, Idaho Falls, Idaho), which Luna states act to validate the use of the Jardine results for spent fuel, are inconclusive. The data from the MacDougall study is in the very low energy density range, and they cannot be used to demonstrate any correlation without more data points taken in the higher energy density range. The Alvarez study appears (the graph in Luna is hard to read) to provide respirable percents from 2% - 40% at an energy density approximately 7 times smaller than the density estimated for the HEDD. Regardless of any of these uncertainties, the Luna study assumes one value for the respirable fraction produced and places no uncertainty boundaries on it.

Third, Luna assumes that the HEDD will have an energy density of 1/3 that estimated based on the swept volume and kinetic energy of the device. It is argued in the Luna study that since the device penetrated about equal amounts of mass per unit area penetrating the wall of the cask as it did penetrating the fuel rods, the energy available for action on the fuel rods is likely "to be 1/2 to 1/3 of the initial energy density." However, this assumes that the HEDD action on the cask wall does not impart an energy to the fuel rods. Because of this fact, Luna's use of 1/3 of

the initial assumed energy density is an underestimate (using 1/3 instead of 1/2 is an underestimate in itself). Without actual knowledge of the amount of respirable aerosol produced (as in a properly sampled test), the energy density should be assumed to be 100% of the initial.

In order to check the effect of the assumptions made by Luna in correlating the Jardine data to the sabotage benchmark, we calculated the likely aerosol release ignoring all of the objections raised here except for the use of 3µm particles (see attached spreadsheet). Instead, we used Figure 2 from the Luna report to obtain a % respirable production in the energy range given by Luna for the HEDD penetration assuming l0µm-sized particles. Using this, the Jardine correlation estimates that 50-100% of the fuel impacted by the HEDD will be respirable, as opposed to the 5% assumed by Luna. This changes the respirable surrogate fuel aerosol produced estimate from .19kg (Luna) to 1.91-3.82 kg.

Without any direct measurement of the respirable aerosol produced by HEDD penetration, the 5% assumption used is neither conservative nor grounded in reality. Unless experimental studies are conducted that specifically measure this term, a more conservative approximation of 50-100% respirable production must be used.

Spent Fuel to Surrogate Fuel Aerosol Ratio

The Luna report also proposes a reduction in the spent fuel to surrogate fuel aerosol ratio used to estimate spent fuel releases using data obtained with $DU0_2$. Luna lists several experimental estimates of the (spent fuel release/ surrogate fuel release) which vary over two orders of magnitude: .53, 5.6, .71, .42, 3, 2.8, 2.5, 3, 12. The Sandoval report used the value of 5.6, obtained for the analysis using a wet sieve technique. However, Luna questioned the validity of this technique, and concluded that a value of 3 was a more valid ratio, largely based on the only spent fuel aerosol point obtained from any experiments. Again, it is difficult to see how this can be substantiated. For the most conservative approach, the ratio should be the highest one experimentally estimated, which is 12.

In order to determine the effect of using different ratios on the estimation of the source term for a spent fuel release, we recalculated the estimated amount and percentage of fuel released from the truck cask used in the Sandoval experiments in the manner done by Luna in table A-1. We calculated this term while varying this ratio from 3 to 12, in addition to varying the estimated respirable aerosol production from 5%-100%. The results are summarized below.

Respirable aerosol production percentage	**Spent fuel-surrogate fuel correction factor**	**Respirable spent fuel produced (kg)**	**Percentage of total spent fuel in cask**
5	3	0.574	0.29%
50	3	1.071	0.53%
100	3	2.294	1.14%
5	5.6	5.736	2.85%
50	5.6	10.708	5.33%
100	5.6	22.945	11.41%
5	12	11.472	5.71%
50	12	21.415	10.65%
100	12	45.890	22.82%

Clearly, the 0.29% release calculated by Luna is not conservative. This is important because the same assumptions about spent fuel-surrogate fuel ratios and respirable aerosol productions are used when estimating the effects of HEDD impact on newer-generation casks. As is shown above, these assumptions are incorrect and lead to highly incorrect results. Because of this, it is recommended that experimental tests be performed subjecting new generation shipping casks to HEDD impact, rather than to rely on an incorrect computer simulation.

SCAP computer code used without sufficient benchmarking

The Luna study attempts to utilize a computer model as a replacement for actual experimentation in order to determine the possible damage caused by two HEDD's on state-of-the-art shipping casks. However, the code that

they use admittedly does not model multi-layered targets well. The Luna study "benchmarks" the SCAP code against the Sandoval full-scale test and determines that the code predicts penetration depth well, but underestimates the size of the hole created by the penetration. In an attempt to remedy this, the Luna report multiplies the predicted hole size by a factor of 2.0 to obtain "correct" results, then proceeds to do the same when modeling other cask designs. This approach is seriously incorrect. It assumes that the code will consistently model all cask layer or shell arrangements, including different numbers of layers, which is incorrect. Important to this analysis is understanding the reasons why the SCAP code underpredicts the hole diameter. According to Luna, "underestimation is believed to be a result of some secondary effects, such as the dispersive layered nature of the targets, the relatively unfocused nature of the HEDD1, and the near one-dimensional nature of the flow dynamic of the code." (23) The SCAP user's manual addresses the problems in applying the model to predict penetration characteristics on multi-layered targets, stating that "there may exist interface phenomena not modeled by the code which could result in serious difficulties in comparing SCAP modeling output and experimental data. For a *limited number of interfaces* the code should still be useful." (27, emphasis added).

Below is a table comparing the cask used in the Sandoval study with the casks used in the Luna model.

Cask used in Sandoval:		**Truck Cask used in Luna**		**Rail Cask used in Luna**	
Steel-lead-steel Weight (ton)	25	steel-uranium-steel weight (ton)	25	steel-uranium-lead-steel weight (ton)	125
Inner cavity diameter (cm)	69.86	Inner cavity diameter (cm)		Inner cavity diameter (cm)	162.56
Length (cm)	490.22	Length (cm)	406	length (cm)	
Steel outer shell thickness (cm)	3.175	Steel outer shell thickness (cm)	3.81	steel outer shelf thickness (cm)	4.60375
Lead Wide thickness (cm)	16.84	Uranium middle thickness (cm)	7	lead middle thickness (cm)	1.27
Steel inner shell thickness (cm)	0.79	Steel inner shelf thickness (cm)	0.9525	uranium middle thickness (cm)	5.55625
Neutron Shield: water jacket, empty (cm)	1143	Neutron Shield: steel outer layer (cm)	0.3175	steel inner shell thickness (cm)	3.81
		Neutron shield: polypropylene layer (cm)	11.43	neutron shield: steel outer layer (cm)	0.635
				neutron shield: water jacket layer (cm)	15.24
1 PWR assembly		4 PWR assemblies		26 PWR assemblies	

Looking at the above table, it becomes apparent how different the three casks actually are from each other. They consist of different materials in different proportions, can carry different numbers of fuel assemblies, and have different sizes and weights. Regardless of these factors, the analysis carried out in the Luna report assumes that the correction of "2.0" to the predicted hole diameter is appropriate for all of the casks above.

As is shown on Table 1 of the Luna report (p. 34), the casks are broken down into different layers to be used as input into the SCAP code. What is important to note is that with every different layer, there exists an interface which is not modeled by the SCAP code. For the cask used in "benchmarking" the code, these interfaces were air-steel, steel-lead, and steel-PWR assembly, along with the various interactions in the assembly itself A factor of 2 difference between the predicted hole size and the larger experimental hole was attributed to difficulties in modeling these interface phenomena, among other things. This factor of 2 was then assumed to account for the interface phenomena in the other casks listed above, even though these casks have different interfaces and different numbers of layers. There is no justification of this step.

The use of the SCAP code to model cask response to shaped charge attack without having an appropriate experimental model to calibrate with is unacceptable. The SCAP code consistently underpredicts the diameter of the hole created by the explosion of the M3A1 device against the outdated cask used in the Sandoval report. The only justification that has been given for using a factor of two to correct this underprediction is that this makes the code

correlate with experimental results. Therefore, it seems necessary to conduct new experiments using the newer casks to determine how to correlate the SCAP code with these experimental results. Since the newer casks have different numbers and types of layers, and since new HEDD devices are modeled by the code, it is likely that the deviations from experiment will be significantly different from those in the Sandoval case. Therefore, the Sandoval test results must not be used to calibrate the SCAP code for new casks and HEDD's.

Further, it appears that the PWR assemblies were modeled as having a single, uniform density which was taken as an average of the densities of the fuel rods, the uranium, and air. This leads to the false assumption that the penetration of the HEDD will be consistently impeded by dense material, rather than using the reality that the HEDD will find a very mixed environment with respect to density inside the cask cores.

In summary, the SCAP code simply cannot be used to provide a reliable or conservative estimate of the amount of damage expected to be caused by a HEDD on a multi-layered, modem cask. Unless there is experimental evidence that confirms the estimations presented in the Luna report, they should not be used as credible indicators of the effects of a successful sabotage event. The admitted shortcomings of the SCAP code - namely that it does not accurately predict penetration phenomena into multi-layered targets- prevents this code from offering useful information, especially since there have been no actual experiments to back these predictions up. It is not sufficient to benchmark the code against experiments performed on an outdated cask having fewer and different layers. Actual experiments must be performed with potential HEDD's in order to assess the validity of the SCAP predictions. Until this is done, the results remain irrelevant.

Omission of important sabotage scenarios

Intermodal transfer station sabotage event

The EIS, on pg. J-95, states that section J.1.5 evaluates the effects of sabotage on intermodal transfer stations. However, there is no section J.1.5, and there is no mention of this potential sabotage event again. It is essential to perform an analysis of the likely effects of a successful sabotage event on an intermodal transfer station because of its unique conditions. For one, shipping casks at an intermodal station will be stationary. This eliminates some of the problems associated with striking a pivoting target optimally that were presented in the EIS. Also, this makes the possibility of a multiple Cask release possible. Third, the appeal among potential saboteurs of attacking a station rather than a truck or train must be addressed. Intermodal transfer will also occur at reactor sites without rail access. All of these factors suggest that the potential for sabotage at an intermodal station must be addressed in a comprehensive manner.

Barge transport sabotage event

The EIS does not consider the consequences of a possible sabotage event on a barge shipment of spent nuclear fuel. As this is one of the transportation options being considered, it is important to consider the effects of a successful sabotage event, including the breach of shipping casks and release of radioactive material into the air and water, especially near populated areas, water supplies, or natural environments. It is essential to address this concern, especially since there was no discussion of the consequences of severe barge accidents, which were determined by the EIS to be not reasonably foreseeable.

Failure to identify/profile potential "Threat Groups"

It would be helpful to provide some general profiles of potential "Threat Groups" in terms of characterizing exactly what these groups are capable of doing, and the relative likelihood of each group performing a sabotage act. This would help in determining what types of weapons, forces, expertise, etc can be expected to be utilized by different groups, providing the DOE with a better estimate of what safeguards must be put in place. The Final Environmental Impact Statement: U.S. Spent Fuel Policy Storage of Foreign Spent Power Reactor Fuel (1980: DOE/EIS-0015) provides a list of "Threat Groups" to nuclear fuel storage and transportation; a similar, but updated, list would be helpful.

Improper dismissal of considering the probabi1ity of terrorist events

The EIS and the Luna report both consistently state that, since sabotage events are not randomly occurring, no estimation of their probability can be made, other than assuming they are "extremely rare." However, some comment should be made concerning the increase in large-scale terrorist attacks and how this relates to the need for sufficient safeguards against such attacks. Even though attacks are not random events, some effort should be made to identify trends, such as the increase in attacks on American soil over the last few years. This provides a proper foundation through which to analyze the level of protection required from terrorist attacks.

Failure to present a true "worst case scenario" for consequence analysis

Use of "averaged" wind conditions instead of wind blowing in one direction

The inputs used by the DOE in determining health effects of a successful sabotage scenario assume generalized wind conditions. For a true worst Case scenario, the impact of a radiological release directly downwind from a large population center, such as an office building, prison, stadium, etc. must be addressed. The use of wind conditions averaged over all directions dilutes the effect of a single-direction wind event.

Use of "average" (neutral) weather conditions, instead of worst Case conditions
The EIS states that, because the time and place of a sabotage event cannot be predicted, average weather conditions for the entire United States must be used. However, it seems likely that potential saboteurs will, to the degree feasible, plan sabotage events around those weather conditions that are the most damaging. Thus, for a true "worst case" sabotage scenario, weather conditions leading to the greatest consequences should be used.

"One bullet assumption"

As has been previously discussed, the consideration of only a single HEDD strike in the simulation of a sabotage event is unrealistic. Terrorists who are serious about causing a significant release of radioactive material, and who have the means of obtaining armor-penetrating weaponry, will likely bring a complete arsenal, including several armor-penetrating devices, incendiary devices, etc. Therefore, cask response to multiple missile penetrations, especially if they are fired in succession such that missiles strike an already damaged cask, must be addressed. It is extremely likely that the damage done to an already-penetrated cask will be substantial. This has not been assessed by the DOE and must be in order for the sabotage portion of the EIS to be considered complete.
Failure to assess social, psychological, environmental, or economic costs

In order to be able to assess the consequences of a successful sabotage event satisfactorily, the full scale of effects must be studied. The DOE has commissioned studies addressing the psychological impacts of radiation accidents on the public, but similar studies have not been performed for this EIS. In addition, no consideration of the cost of cleanup of such an event is given. Below is a skeleton outline of the various factors not considered by the EIS that need considerable attention.

Social/psychological costs not addressed
- Increased fear of nuclear energy, and nuclear industry
- Fear of vulnerability to attack (see Oklahoma City bombing)
- Susceptibility of foreign-born citizens to discrimination
- Distrust of government that transports materials capable of such destruction

Environmental costs not addressed
- Groundwater and/or surface water contamination more human costs
- Loss of land use near site for significant amount of time

Economic costs not addressed
- Cleanup costs
- Decontamination costs
- Lost workdays due to radioactive contamination of roads, buildings, etc

Loss of tourism in Las Vegas, e.g., due to contamination or fear
Evacuation costs
Relocation costs

Response
This comment has two main components. The first deals with a critique of the Sandia study (DIRS 104918- Luna, Neuhauser, and Vigil 1999); the second with aspects of the Draft EIS. The critique of the Sandia study has five major sections, to which DOE has responded in order. The part of the comment that deals with problems in the Draft EIS has four major sections.

Criticisms of Luna, Neuhauser, and Vigil (1999):

1. Inadequate Selection of Reference Weapons and Reference Cask. For security reasons DOE cannot state specifically which high-energy density devices (HEDDs) were considered. The analysis provided is expected to envelop the damage that might be produced by modern weapons in a successful sabotage event. The cask tested in Sandoval et al. (DIRS 156313-1983) to produce the data used as the basis for the analysis was not modern, but the use of the SCAP computer code allowed the results from that steel/lead/steel cask to be applied to modern cask wall designs using depleted uranium or lead shielding.

   It is possible that a sabotage attack could involve a fire. Whether the fire could enhance the consequences would depend on their location in relation to the cask and duration. A fire collocated with the cask could cause a greater release of material, but that material would be transported aloft in the plume of smoke and become unavailable for causing radiological impacts near the cask. The additional dispersion from fire-generated turbulence would mean that radiological doses a kilometer or so downwind of the cask would be only slightly higher. The net effect would not be proportional to the increased release.

2. Improper Extrapolation of Previous Experiments to Current Cask Designs. The commenter makes a valid comment with regard to the equation in the report for swept volume. It is incorrect as printed; the number of rows of pins along the disruption path should not be divided by the pin pitch, and the disruption path should therefore be unitless. The actual calculations in the report were rechecked and found to be correct.

   The tests discussed in Sandoval et al. (DIRS 156313-1983) provided both full penetration (two-wall) and one wall penetration results for subsequent use.

   The mass of respirable aerosol exterior to the cask from Sandoval et al. (DIRS 156313-1983) were restated in terms of a fraction of swept volume to use the release fraction results for other HEDDs which might produce a different diameter and length of damaged fuel. The release fraction for a single entry hole case was used as the basis of the calculation of release fraction because the SCAP computer code did not project that either of the HEDDs considered would penetrate both walls of the two representative cask designs considered. Were a through hole produced, a higher release fraction would have been used, but that was not the case. Thus, the increase in release fraction of a factor of 10 as suggested by the commenter is not warranted.

   The thermal properties of shielding material have little effect on the predicted geometry of penetration from use of a HEDD. Penetration is unrelated to thermal effects; it is related to density, depth, and, to some extent, strength of the materials with which the device would interact.

   While multiple holes could lead to an increased release fraction, as suggested by the commenter, the result is unlikely to be additive. This results because the driving pressure from rod pressurization that was postulated to enhance the release fraction over that measured by Sandoval et al. (DIRS 156313-1983) would be lower for each successive hole as the number of undamaged fuel pins get smaller. Without a mechanism for producing a strong flow out of the cask, respirable material within the cask is likely to plate out on the huge surface area within the cask. Thus, DOE believes that it has adequately bounded the sabotage consequence scenario.

   The commenter suggested that multiple holes would allow a flow of air into the cask that would enable exposed UO_2 to oxidize to U_3O_8 [when temperatures exceeded 250ºC (482ºF)], which is asserted to be a fine powdery material. While the oxidation process could occur, achieving temperatures of 250ºC to make the process occur

quickly could not occur easily. Penetration by the weapon would not increase temperature noticeably inside the cask, and fires would take some time to get enough heat into the cask to raise temperatures above 250ºC. Moreover, conversion to U_3O_8 in the cask does not mean that particles would escape from the cask or that they would be small enough to become a significant health hazard. Because this scenario requires even more aspects of the sabotage event to proceed perfectly, it becomes increasingly unlikely.

The commenter suggests that more analysis is needed before the swept mass can be used as a correlation factor and that all HEDDs may not produce the same aerosol fraction related to swept mass. Since the publication of the Draft EIS and Luna, Neuhauser, and Vigil (1999), additional data has become available in a paper by Luna (DIRS 157201-2000). This paper describes with three experiments in which an unspecified HEDD penetrated a ductile cast-iron CASTOR cask containing nine mocked-up pressurized-water reactor fuel assemblies. Each assembly was made up of pressurized fuel rods filled with unirradiated fuel pellets. Two experiments were substantially the same. Each yielded a respirable release exterior to the cask of about 1 gram of aerosol. A third experiment was done with the cask interior at a pressure of 0.8 atmosphere, which yielded a release of about 0.3 gram of respirable aerosol. These releases include the cask purging effect of the release of rod plenum gases. The experiment described in Sandoval et al. (DIRS 156313-1983) yielded a respirable release of 3 grams but included no rod pressurization to create a purging flow that would force additional respirable material out of the cask. The two results are close, but the conditions for each were different.

Luna (DIRS 157201-2000) used the swept mass concept to relate these experiments. The respirable release fraction scaled to swept mass for the first two experiments was about a factor of 2 smaller (DIRS 156313-Sandoval et al. 1983). Based on the CASTOR experiments, which suggested that little of the aerosol in assemblies behind the first one penetrated was likely to find its way to the entry hole and be released, the fractional respirable aerosol release fraction was found to be quite close to the value for the Sandoval et al. (1983) experiment. This value includes the effect of releasing rod pressurization gas. This suggests that scaling the release to swept mass is a workable concept for translating experimental results to other situations.

Scaling the diameter of the cavity predicted by the SCAP computer code by comparing its predicted diameter to that observed in two experiments is an approximation that is believed to give reasonable results. What was most important in the SCAP results was the penetration depth prediction that was key in selecting the appropriate scaling factor to swept mass (full penetration versus one wall). As indicated in Luna, Neuhauser, and Vigil (DIRS 104918-1999), SCAP predicted penetration depth closely in two very different configurations. This provides confidence in the overall validity of the estimate of the swept mass from Luna, Neuhauser, and Vigil (1999).

3. Respirable Aerosol. Estimating the total quantity of respirable aerosol in the cask was needed to account for the purging effect of rod plenum gas release that was not simulated in the tests described in Sandoval et al. (DIRS 156313-1983). The commenter takes issue with several aspects of the analysis and concludes that instead of 5-percent respirable the result should have been 50 to 100 percent. Several issues were raised in support of that contention.

3.1 Respirable Particle Diameter. One of the first issues is what constitutes a respirable aerosol. The International Commission on Radiological Protection lung model suggests that the aerodynamic diameter of particles must be smaller than 10 micrometers to reach the lung in significant quantity. To convert aerodynamic diameter to geometric diameter, divide by the square root of the particle density. Thus, uranium oxide particles with a density 10.5 grams per cubic meter must have a diameter of 3.1 micrometers or smaller to be inhalable. Uranium oxide particles with a geometric diameter smaller than 10 micrometers, suggested by the commenter as being respirable, have an aerodynamic diameter of 32 micrometers that is well out of the respirable range. Using that assumption together and accepting other aspects of the Luna, Neuhauser, and Vigil (DIRS 104918-1999) analysis yielded the 50- to 100-percent respirable estimate made by the commenter. This is clearly not a reasonable value for respirable aerosol.

3.2 Thermal Effects. The commenter states that there could be thermal effects in the experiments described in Sandoval et al. (DIRS 156313-1983) that were not accounted for in Jardine's experiments. Sandoval et al. (1983) saw no evidence of thermally generated uranium oxide aerosols in the experiments; therefore, the

Jardine experimental relationship between aerosol production and impact energy density was used to estimate respirable aerosol production.

3.3 Extrapolation of Jardine's Relationship. Jardine's work included energy densities to 140 Joules per kilogram but the estimated energy range for the Sandoval et al. (DIRS 156313-1983) experiment was between 1,000 and 10,000 Joules per kilogram. The commenter criticizes using results of an experiment at the Idaho National Engineering and Environmental Laboratory together with the Jardine relationship to obtain an estimate of the respirable fraction at the high energy density of the original experiments from Sandoval et al. (1983). As discussed in Luna, Neuhauser, and Vigil (DIRS 104918-1999), the Idaho National Engineering and Environmental Laboratory data are within the likely confidence range for the Jardine data, which gives confidence to the extrapolation.

3.4 Energy Density Estimate. The commenter suggests that the end point of the extrapolation should have been at the full energy of the HEDD before the cask wall was penetrated. This suggestion is contrary to reality. It takes energy to penetrate the wall and the penetrated material flows back and away from the direction of HEDD action. Little of this energy expenditure imparted to the wall material could be directed at the surrogate fuel rods as suggested.

Based on the above, the estimate of 5-percent respirable aerosol production is reasonable based on the analysis presented by Luna, Neuhauser, and Vigil (DIRS 104918-1999), however, the experiments discussed in Luna (DIRS 157201-2000) suggest that even the 5-percent value is too high or that there is more significant deposition of the material in the cask before it is released.

4. Spent Nuclear Fuel-to-Surrogate Fuel Ratio. The commenter suggests that the largest observed value of the ratio (12) should be used rather than the value of 3 used in Luna, Neuhauser, and Vigil (DIRS 104918-1999) or the value of 5.6 used in Sandoval et al. (DIRS 156313-1983). Sandoval et al. used 5.6 as an upper limit, which might have been appropriate for the purpose of the analysis. That document indicated that the appropriate value was about 1. For Luna, Neuhauser, and Vigil (1999), it was judged that a realistic, but conservative, value should be used. Looking at the range of experimental values, a value of three was in the middle of the range and reflected 2 of the possible values. This made it a realistically conservative choice for the analysis.

5. SCAP Computer Code Used Without Sufficient Benchmarking. The commenter overlooked the three benchmarking calculations that were completed on a variety of cask and cask-like configurations. These included the same averaging of surrogate fuel and open space to represent fuel assemblies. The prediction of depth of penetration, which is a key issue in the analysis, was correct. The need to adjust the SCAP-predicted diameter by a factor of 2 was preferable to using the predicted diameter and is not likely to introduce significant error in the analysis.

Criticisms of EIS:

1. Omission of Important Sabotage Scenarios. The commenter identifies two additional scenarios, involving an intermodal transfer station and barge transport. Spent nuclear fuel casks at an intermodal transfer facility would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR Part 73), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

   Barge transport sabotage scenarios were considered in Appendix J of the EIS. While there could be the opportunity for a radiation dose from releases to surface water as a result of a barge accident or sabotage, the consequences would be likely to be much less than releases to the atmosphere (DIRS 157052-Ostmeyer 1986).

2. Failure to Identify/Profile Threat Groups and Improper Dismissal of the Probability of Terrorist Acts. The threats against which spent nuclear fuel shipments must be protected are known as "design-basis threats," and are defined in 10 CFR Part 73. Profiling threat groups is beyond the scope of this EIS. With regard to the

probability of terrorist acts, because of the attacks on September 11, 2001, DOE and other agencies are reexamining the protections built into their physical security and safeguards systems. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

3. Failure to Present a True Worst-Case Scenario for Consequence Analysis. The Council on Environmental Quality rescinded the requirement to perform a worst case analysis in an EIS in 1986 (51 *FR* 15618, April 25).

3.1 Use of Averaged Wind Conditions Instead of Wind Blowing in One Direction. The atmospheric data used in the sabotage analysis was a joint frequency of wind speed and stability class. As suggested by this comment, the wind was assumed to blow toward the population, and consequences were estimated for an urban area.

3.2 Use of Average (Neutral) Wind Conditions, Instead of Worst-Case Conditions. The Council on Environmental Quality rescinded the requirement to perform a worst case analysis in an EIS in 1986 (51 *FR* 15618, April 25).

3.3 One-Bullet Assumption. As discussed above, while multiple holes would probably lead to an increased release fraction, as suggested by the commenter, the result would be unlikely to be additive. This results because the driving pressure from rod pressurization that was postulated to enhance the release fraction over that measured in Sandoval et al. (DIRS 156313-1983) would be lower for each successive hole as the number of undamaged fuel pins got smaller. Without a mechanism for producing a strong flow out of the cask, respirable material inside the cask would be likely to plate out on the huge surface area inside the cask. DOE believes that it has adequately bounded the sabotage consequence scenario.

4. Failure to Assess Social, Psychological, Environmental or Economic Costs. In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. Section J.1.4.2.5 discusses environmental restoration after a release of radioactive material. Social and psychological issues are discussed in Appendix N.

8.10.1 (5620)
Comment - EIS001887 / 0246
Page 4-65; Section 4.1.8.3 - Sabotage
The Draft EIS examines a scenario involving low-level exposures in the waste-handling building which can contain radionuclides but not a more serious incident outside of a building, such as a breached cask/container in Caliente. (See Appendix A, section A 2.2/A 2.3) The assumption made in the Draft EIS that "rural targets" for terrorists are non-desirable has recently been proven wrong with the Amtrack derailment in Arizona. The proposed intermodal transfer station would make an attractive and potentially vulnerable target secluded in a canyon with clear overhead shots available.

Response
Spent nuclear fuel casks at an intermodal transfer facility would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR Part 73), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments and key facilities. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (6127)
Comment - EIS001654 / 0016
Perhaps it has been studied previously by DOE, but we are unsure whether sabotage threats have been analyzed and compared for shipment of nuclear waste by the various modes. It is possible that one of the attributes of rail shipment that may be advantageous for accident risk exposure may also be a disadvantage in terms of vulnerability to terrorism or other willful attempts to interfere with the shipments. We are not experts in such analyses, but we recommend that the transportation mode selection decision criteria be identified and views of various experts and perspectives be considered in making the optimum mode selection based on a comprehensive risk assessment.

Response
The radiological accident risks estimated in Chapter 6 of the EIS would be sufficiently small so that there is no rationale for using radiological accident risk as reason for selecting a transportation mode.

Both truck and rail spent nuclear fuel shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (6372)
Comment - EIS001587 / 0002
So we proceeded to embark upon a study of terrorism. We used eight different methodologies in attempts to breach these casks. I am not going to tell you what those were. I am not going to provide you with a cookbook. But I will tell you one that didn't work. This was long before the Alfred P. Murrah Building in Oklahoma City, and we used 5,000 instead of 4,000 pounds of ammonium nitrate fuel oil, 10 feet away from a simulated cask. We bent it like a banana and hurled it a hundred feet, but if it had been a real cask, it would not have released any material. That was an unsuccessful method.

We found, indeed, there are ways to open these casks using explosives. We consulted terrorism experts and we were told that terrorists need basically four things. They need the expertise, and there are those people with the expertise. They need the tools, and there are those people who have the tools. They need access to the cask, and we strive hard to prevent that access.

For one thing, each one of these shipments has a transmitter on it and we know within a hundred feet where it is at all times, and if it's diverted we know it immediately. And, fourthly, they need time. The less time you can give them, the lower the probability of a successful attack, and, again, part of our system is to reduce that available time. So, given that, even so, we did find that there are ways to breach the cask.

What we did find is of interest to the terrorists as much as is to you. We selected one method and we conducted an experiment on a shipping cask that had seen service and was retired from service, and we put this thing in a giant

bottle and then we attacked it explosively, and we poked a hole in the cask, and we collected all of the material that came out of the cask, and we weighed it and we weighed all the material that was still in the cask, so we knew exactly how much material came out.

We, furthermore, screened the material so we knew what the respirable sizes were, or what the particle sizes were and we could, therefore, infer how much of that cask came out respirable material. All of this done in a bottle.

Now, prior to doing this, we had estimated that an attack of this sort would release one percent of the contents of the cask. And our finding was that it released one ten-thousandth of that amount, .0001 percent.

Now, if you look at that kind of an attack and you conduct it in Manhattan at rush hour on an intersection, the explosion would kill about 400 to 500 people. The release of radioactive materials from the cask, would result in two-tenths of one latent cancer. So the problem is not the release of material. The problem is the explosives and the terrorists know that and so this becomes an unattractive target.

Response
This comment is basically correct as it relates to the experiments carried out at Sandia National Laboratories in the early 1980s. Later analyses reinterpreted that data and extended the estimate of release to current cask designs and spent nuclear fuel loads. While there is a modest increase in expected consequences resulting from cask loading and design, the basic conclusion given in the comment is correct.

8.10.1 (7084)
Comment - EIS000995 / 0006
Once the high-level radioactive waste leaves the reactor sites, how will you avoid accidents or sabotage all along the shipping route? Will emergency management personnel all along the route be fully trained and equipped for a "criticality" accident? What can they really do other than cordon off the area?

Response
Section 6.2.4.2 of the EIS provides information on the data and methods used to analyze transportation accidents. Additional information provided in Section J.1.4.2.1 discusses actuarial data and potential effects of human error on accident impacts. Avoidance of accidents and getting a shipment of spent nuclear fuel or high-level radioactive waste (or any other material) from origin to destination safely would primarily be the responsibility of the management and crews operating the vehicles. The DOE Regional Servicing Contractor would ensure that crews were appropriately trained as required in U.S. Department of Transportation regulations (49 CFR Part 171) and that all operational requirements on the shipments would be met. Section M.3.2 provides some additional information on the operational procedures and protocols required by DOE for shipments. Section M.5 provides additional information on emergency response requirements and responsibilities among state, Federal, and local organizations. As discussed in Chapter 2 of the EIS, the Department would be responsible for implementing the requirements of Section 180(c) of the NWPA by providing funds for determining need for and training state, tribal, and local authorities for the safe transport and response to potential emergencies involving these shipments.

Additional information on stipulations of Section 180(c) is provided in Section M.6 of the EIS. Dealing with a criticality event in an accident is not a goal of the emergency response function. The Nuclear Regulatory Commission certification requirements for casks effectively prevent such an occurrence in transport. DOE expects that emergency response personnel would recover and treat those injured from the physical events of the accident, and control crowds, fires, and dispersal of hydrocarbon fuels at the scene. While emergency response crews would be trained to function in a radiological release situation, it is very unlikely that radioactive material would ever be released from an accident involving a cask. Section M.4 provides additional information on cask safety and testing. Section M.7 provides an overview of procedures used to provide physical protection of shipments.

8.10.1 (7295)
Comment - EIS001832 / 0032
We [The Nuclear Energy Institute] endorse DOE's treatment of sabotage and security risks in this EIS.

A system of safeguards and regulations exist to ensure the safety of the public, handling personnel, and the environment before transport, during transport, and upon arrival of the transport package at its end destination.

NRC [Nuclear Regulatory Commission] will be the lead agency in assessing spent nuclear fuel shipment safety, safeguards, and security. Some of the measures that will ensure safeguarding of spent fuel shipments include:

Periodic updating of route conditions to facilitate use of alternative itineraries en route as conditions warrant.

Route approval and security arrangements for each shipment that must be approved by NRC

Use of armed escorts in urban areas.

Requirements that State and local authorities be notified of shipments.

Vehicle design features that would prevent the unauthorized movement of trucks carrying spent nuclear fuel (locking devices on trucks used to transport SNF [spent nuclear fuel]).

Response
As pointed out by the commenter, transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (7447)
Comment - EIS001969 / 0006
That there are devices already in existence that can penetrate the truck shipping casks (page 6-33 of the EIS) if used by saboteurs, must not be taken lightly. That the trains and trucks will be guarded solves part of the problem, but not entirely. It is presumed that the guards will be armed, but would that protect against an intentional derailment? If the act of sabotage is successful, how would DOE address response and cleanup or control?

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Cask safety features that provide containment, shielding, and thermal protection also provide protection against sabotage. The casks would be massive. The spent nuclear fuel in a cask would typically be only about 10 percent of the gross weight; the remaining 90 percent would be shielding and structure.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. Section J.1.4.2.5 discusses environmental restoration after a release of radioactive material.

8.10.1 (7449)
Comment - EIS001969 / 0007
We could find no mention, in the EIS, of the possibility of one of the trucks being hijacked. A hijacked truck could be driven anywhere and used as a threat. A hijacked trucks would be most vulnerable when they are stopped so that the guards and drivers can eat or sleep. How does DOE plan to address this situation?

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

8.10.1 (7548)
Comment - EIS000544 / 0003
There was very little about sabotage. We found in fact that the sabotage, the only thing that really related to it was in terms of what could happen at the waste handling building, and it really didn't relate to anything outside in the rural areas in canyons or any of the choke points that occur along these routes.

Lastly, we're finding numerical differences basically in looking at turning radii for operating heavy-haul vehicles on our system as it is now. There are certain summits and curves on routes that are listed that we don't think even a double articulated multi-tractored vehicle can actually traverse and legally stay within its loads.

With that I would like to end my comments by saying that we're not here to really say pro or con on the whole project, but we are adamantly against any heavy-haul option.

Response
The EIS discusses sabotage during transportation in Section 6.2.4.2.3. Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Heavy-haul vehicles do make more demands than other vehicles on the geometry and construction of roadways on which they might be used. DOE has identified mostly rail as its preferred mode of transportation both nationally and in Nevada.

DOE has not identified a preference among the five candidate rail corridors in Nevada. If the Yucca Mountain site was approved, DOE would issue at some future date a Record of Decision to select a mode of transportation. If, for example, mostly rail was selected (both nationally and in Nevada), DOE would then identify a preference for one of the rail corridors in consultation with affected stakeholders, particularly the State of Nevada. In this example, DOE would announce a preferred corridor in the *Federal Register* and other media. No sooner than 30 days after the announcement of a preference, DOE would publish its selection of a rail corridor in a Record of Decision. A similar process would occur in the event that DOE selected heavy-haul truck as its mode of transportation in Nevada.

It is the Department's opinion that the EIS adequately analyzes the potential impacts of Nevada heavy-haul implementing alternatives for transporting spent nuclear fuel and high-level radioactive waste.

8.10.1 (7811)
Comment - EIS001756 / 0002
I would like to start by repeating one statement that I think is extremely important, even though it's been said.

It is estimated that a mixture of approximately 6,000 train and truck shipments would pass through the St. Louis area over the 30 years shipping campaign, or on average one every other day, thus creating the potential for innumerable accidents and terrorist attacks. Terrorists would love to steal our plutonium to manufacture their own bombs or they might just want to demand millions of dollars or other terrorists' release from jail in exchange for not blowing up a high-level radioactive waste transport. With such frequency of shipment, it couldn't be too hard for terrorists to figure out where and when these materials are on route.

If a bomb landed on one of these vehicles or a suicide bomber decided to ram one, we're talking about life-threatening pollution, not just to the surrounding area, but to the entire city. In the DOE's Draft Summary Environmental Impact Statement in a chart of estimated national transportation impacts for 24 years of operation, latent cancer fatalities from maximum reasonably foreseeable accidents are five for mostly truck scenarios and 31 for mostly rail scenarios. These estimates could not possibly have included potential terrorist attacks. Apparently there is some concern about such attacks, as the Nuclear Regulatory Commission will require two armed escorts for every shipment of irradiated fuel rods. Such guards might have been able to save the stagecoaches of days past, but I have little hope that they could overpower modern terrorists.

While I am deeply disturbed about the danger to citizens from these transportation risks, the situation at the Yucca Mountain site itself could be described as a terrorist's dream. If the plan is approved, shipments could begin as early as 2004, but they'll have no safe place to go. Supposedly nuclear wastes can begin to be loaded into the new facility when it is 10 percent completed, but until that time they will be huddled together like a flock of sitting ducks on a parking lot, a perfect target even for an air attack.

While our Department of Energy may not fully acknowledge the peril in transporting high-level nuclear wastes, we don't have to look far to find others around the world who do. Last Saturday's New York Times reported the following: "Bowing to renewed concerns about terrorist attacks, Panama authorities said today that they were beefing up security to protect a British ship carrying radioactive cargo through the Panama Canal this weekend. 'The vessel is a visible target for any group that wants to make a statement,' Jorge Quijano, director of maritime operations for the Panama Canal Authority, said in an interview today. Environmental groups fear that the ship carrying high-level waste to Japan from France is vulnerable to terrorists who could board and dislodge or rupture the casks with the waste, threatening a potentially catastrophic release of radioactivity." Paul Leventhal, a representative from the Nuclear Control Institute in Washington commented, "The consequence of a release of radioactive waste would be long-lived. It would be very hard to clean up, and it could render the canal inoperable and the surrounding areas uninhabitable."

The very thought of submitting countless numbers of our citizens to the possible disasters herein described is incomprehensible.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

In addition, 10 CFR 63.21 requires a repository at Yucca Mountain to have physical protection consistent with 10 CFR 73.51. This regulation specifies a performance objective, which provides "high assurance that activities involving spent nuclear fuel and high-level radioactive waste do not constitute an unreasonable risk to public health

and safety." The regulation requires that spent nuclear fuel and high-level radioactive waste be stored in a protected area such that:

- Access to the material would require passage through or penetration of two physical barriers. The outer barrier would have isolation zones on each side to facilitate observation and threat assessment, would be continually monitored, and would be protected by an active alarm system.

- Adequate illumination would be provided for observation and threat assessment.

- The area would be monitored by random patrol.

- Access would be controlled by a lock system and personnel identification would be used to limit access to authorized persons.

A trained, equipped, and qualified security force would be required to conduct surveillance, assessment, access control, and communications to ensure adequate response to any security threat. Liaison with a response force would be required to permit timely response to unauthorized entry or activities.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments and key facilities. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (8472)
Comment - EIS000817 / 0144
P. 6-33. If this Sandia study is anything like the "sanitized" one I studied for our hearing on the VSC-24 cask, I distrust it. You can't analyze a cask using only a part of a rod or an aimed missile, or balloons (that mostly burst) to test radiation in the air -- the whole thing was a mess and unrelated to the real thing as I saw it. I have not seen this Luna Neuhauser 1999 study, but if it relies on a General Atomics cask holding only 4 assemblies -- I say get real! You are planning on using casks for 21 assemblies, aren't you? And dual purpose casks aren't even certified or used yet.

Response
The Sandia study (DIRS 104918-Luna, Neuhauser, and Vigil 1999) estimated the radioactive material release fraction for a truck cask (4 pressurized-water reactor assemblies) and rail cask (26 pressurized-water reactor assemblies) that might result from optimal attacks using two different high-energy density devices. DOE used those release fractions in its analysis and is confident that the results from that study are realistically conservative based on information currently available. Similar analyses can be applied to other cask designs as they become available, but it is not expected that results would be markedly different.

8.10.1 (8503)
Comment - EIS001737 / 0002
We aren't even allowed the liberty of buying milk that is labeled non-hormone treated or other food stuffs labeled non-genetically fiddled with. Haul the stuff by rail -- no. Haul it by highway -- no. Today's trucks can't even turn a corner without getting over into the other person's lane. Not only do we have normal accidents and human error involved, but we have now the threat of deliberate terrorism. What happens when a terrorist plot or some other more common occurrence causes a nuclear-loaded truck or train to go off a bridge on I-44, either on the highway I-44 or railroad bridge over the Gasconade River near Waynesville. The water is subsequently flowing into the Missouri River, then into the Mississippi just above St. Louis.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The

objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

It is the Department's opinion that the EIS adequately analyzes the potential impacts of sabotage.

8.10.1 (8612)
Comment - EIS001837 / 0010
What about the crossing of the vast East Mojave wilderness managed by the Bureau of Land Management and the National Park Service? The DEIS fails to address the issue of terrorist attacks in the East Mojave, the impact of spills in the East Mojave National Preserve.

What alternative routes would be used that would impact operations in the East Mojave National Preserve? How are agencies prepared to manage nuclear waste spills and accidents and cleanups? How will they manage visitors in the area?

Response
Shipments of spent nuclear fuel and high-level radioactive waste would occur primarily on Interstate System highways and mainline railroads. As a result, in the event of an accident, there would probably be relatively good access to the accident site without additional disturbance of the wilderness. In the unlikely event of an accident, cleanup, recovery, or access limitation actions would have to balance the impact on the wilderness with future safety of people in the area.

Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

8.10.1 (8733)
Comment - EIS001317 / 0001
Recently our local Citizens Advisory Panel to the chemical industry was denied risk management plan information on a worst case scenario basis due to FBI [Federal Bureau of Investigation] concerns for terrorist activities. This covered Fixed chemical plants of different sizes and relative risks. No thought was considered to the shipment of materials and no cumulative risk was considered due to the number of plants in the area.

With all the variables to consider in the shipment of nuclear waste no such concern for terrorism has been expressed in today's presentation by DOE.

Response
The EIS discusses sabotage in Section 6.2.4.2.3. Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting

the environment and public health. Section M.7 provides additional information on the physical protection of spent nuclear fuel during transportation.

8.10.1 (9184)
Comment - EIS002123 / 0003
Here's the picture and they've got the cask here and it says: "Armed guards and radiation experts escort a truck transporting a nuclear waste cask from an indoor storage pool at Calvert Cliffs nuclear power plant to a new outdoor storage bunker nearby," and they've got guns and they've got masks on their faces and they've got this cask surrounded, and it's just going to a grove of trees. I wonder what they'd -- what terrorist would do with it if it takes -- for one cask for all these people to guard it to this extent?

Response
The security requirements of nuclear power stations are such that armed guards are required whenever the exterior access doors to the spent nuclear fuel pool (or other sensitive areas) are open. The crew charged with the loading of the cask would be in full protective clothing with masks as they completed the cask loading operation.

8.10.1 (9269)
Comment - EIS001618 / 0004
I did find a fascinating section called the impacts of acts of sabotage on page 6-33, which considered the impacts of successful sabotage attempts on a cask, the casks that most of us have never gotten to see and don't really know how they'll work. We certainly don't know in what ways they've been tested. But don't worry because for the ones that are being shipped on trucks, and the analysis estimated that a sabotage event occurring in an urbanized area could result in the population dose of 31,000 person REM, which would cause an estimated 15 fatal cancers among the population of exposed individuals.

This number is so farcical that the idea that a successful -- I mean, these are casks made out of uranium. So we can look at research that is going on into servicemen as well as native populations in Iraq that have been dealing with depleted uranium shells and probably find higher cancers than that. But the idea that a successful sabotage event in a city like Chicago might cause 15 cancers is the sort of disinformation that one really associates with the Soviet Union denying any of the deaths from Chernobyl, rather than an actual seriously peer reviewed government document on the environmental impact of transportation problems.

And it goes down to 2.4 fatal cancers if it happens out in a rural area, so the farmers should feel totally at ease that the food they sell, I assume that's been irradiated, won't in any way cause cancers.

Not only actually interim during the time its transiting, but any one of these casks could stop, break open, in many other ways be breached. And I like the way this section actually talks about a sabotage event cannot be characterized as a random event. So we are pretty much assuming they are going to happen.

Response
Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area. The fact that some casks contain uranium shielding does not mean that a sabotage attack on such a cask would produce a significant additional radiological or environmental impact compared with the result of the sabotage attack itself.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (9422)
Comment - EIS001584 / 0002
I would like to refer to these casks. In 1976, Hunt Spatza, one of our prominent post Manhattan project physicists at Cornell, was promoting these casks being used on railroad cars. Now, at that time, 15-year-olds were pranking, sending freight trains off to Coventry, as the British would say, off to remote areas….

So that no matter how good your casks are, you're stuck with a time in our life that creates problems more in the area of the Nevada people, their focus on things outside of the technical.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage, and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. For these reasons, deliberate misrouting of spent nuclear fuel shipments is unlikely.

However, because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (9566)
Comment - EIS001888 / 0239
The DEIS failed to credibly address problems of security and terrorism. Security problems should have been prominently discussed. The only discussion of the issue was confined to the cursory refutation of arguments made by the State of Nevada. No discussion of eco-terrorism, civil disobedience, or the diversion of military equipment was included.

Response
The repository and spent nuclear fuel shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of nuclear facilities and spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR Part 73), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health.

In response to comments, additional information is provided in Appendix M of the EIS on safeguards and security requirements that would be imposed by DOE and the Nuclear Regulatory Commission. Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (9597)
Comment - EIS001888 / 0271
Security/Escort

The State of Nevada has successfully argued that the Nuclear Regulatory Commission (NRC) should reconsider the security requirements for handling SNF [spent nuclear fuel]. The DEIS presents no information on the contribution security arrangements will make on the transportation of SNF. This is unfortunate because many responsible trucking companies have developed sophisticated systems for handling sensitive materials that would assist public understanding of the safety systems that can confound potential attackers. The DEIS should have included a description of the contribution to risk made by security and escort programs for each of the modal and implementing alternative options.

Response
The Nuclear Regulatory Commission has not ruled on the State of Nevada petition to reconsider security requirements for spent nuclear fuel but, if the Commission should change its requirements, DOE will incorporate those changes in its procedures. Section M.7 of the EIS contains information on safeguards and security requirements that would be imposed by DOE and the Nuclear Regulatory Commission.

8.10.1 (9631)
Comment - EIS001888 / 0300
The DEIS does not provide a credible analysis of the potential consequences of effects of terrorist activity. In June of 1999, the State of Nevada petitioned the Nuclear Regulatory Commission (NRC) to perform a comprehensive assessment of the security requirements for shipping radioactive waste. This much-needed assessment could establish that there is a definite terrorist threat to shipments of Spent Nuclear Fuel (SNF) and that shipments of high-level waste through Clark County, Nevada en route to Yucca Mountain could be especially vulnerable. The threat of terrorist activity is not trivial and should be taken seriously in the DEIS. The DEIS should be considered insufficient until a credible estimate of the likelihood and consequences of terrorist activity is completed. The DEIS is insufficient because it fails to consider the threat to shipments posed by a wide array of terrorists. The threat should be considered for each of the implementing alternatives considered by the DEIS.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (9633)
Comment - EIS001888 / 0301
To date, two threats against spent fuel shipments have been reported in the United States since 1984. In November 1984, Northern States Power (NSP) shipped spent fuel from the Monticello reactor in northern Minnesota to a storage facility at Morris, Illinois. On February 4, 1985, NSP received a telephone threat warning that a group of anti-nuclear protesters would use a small airplane to stop a train carrying spent fuel from Monticello to Morris. On October 27, 1986, an unknown party removed a 39-foot long section of rail along the Burlington Northern route used for these shipments in Golden Valley, Minnesota. Authorities found a sign reading “Stop RadWaste Shipments” near the tracks. This incident did not result in damage to the train transporting spent fuel. However, a Burlington Northern train hauling lumber, scheduled immediately prior to a train transporting spent fuel from Monticello, derailed at the site of the sabotage.

Clark County believes that the threat of a terrorist attack on a spent fuel shipment capable of causing radiological sabotage should be considered credible and should be evaluated in the DEIS. History clearly suggests that although the terrorist threat may be low, it is not so low that it can be ignored.

The FBI found that the major determinants of the character of a terrorist attack are: 1) the technological means, 2) the political motivation behind the attack, and 3) the weaknesses of the target. The FBI believes that changes will occur in the motivations and goals of terrorist groups. Traditional motivations for terrorism (ethnic, tribal, and

religious animosities) will continue and intensify. The disintegration of the Soviet Union and Yugoslavia have fostered entirely new groups that are both well-equipped and well-schooled in terrorist activity. As the World Trade Center bombing demonstrates, terrorists activities span the globe.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (9634)
Comment - EIS001888 / 0302
Clark County presents terrorists with an attractive target for a number of reasons. Each of these reasons, taken individually provides a sound rationale for concern about a terrorist threat. When viewed together, they present a compelling argument in favor of anticipating a terrorist event of some sort. These reasons, visitors, operational consideration, infrastructure, military facilities, and symbolic value are discussed below.

Visitors

"Major events taking place inside the United States may be seen as attractive targets for terrorism."

Clark County's population is an attractive target for terrorists. The sheer number of visitors to Clark County (31 million visitors in 1998) provides terrorists with an attractive target. The concentration of people created by Clark County's mega resorts make it possible for terrorists to craft an attack that would contaminate a large number of people. An example of this concentration is easily exemplified by the intersection of Tropicana and Las Vegas Boulevards. On the comers of this intersection, are 16,500 hotels rooms-more than are in the entire City of San Francisco. Clark County's hotels are usually 91% occupied. This inflames the problems faced by emergency services should an evacuation be necessary. A terrorist attack on a spent fuel shipment in the valley could create an accident that would overwhelm the ability of local emergency management agencies to provide protection and evacuation.

Exacerbating the problems faced by the County is the large number of special events of all types and sizes. Perhaps the largest of these is COMDEX, the world's largest computer exposition. Special events can draw up to 250,000 people to the city from all over the world. It is likely that terrorists would schedule an attack to coincide with a well-known event in order to amplify the effects of their attack through media exposure. This occurred at the Munich Olympic Games, the Atlanta Olympic Games and several others. As the FBI report notes, terrorists select targets with care and sophistication. Terrorist activities have a ready-made target in Clark County. The DEIS should present a worst Case terrorism scenario that coincides with an important local event.

Symbolic Value

The number of tourists present in Clark County has value from a terrorists' perspective not only because of the increased number of potential victims. Terrorist select targets based on their symbolic and political value. One

prominent author paraphrases Clausewitz by characterizing terrorism as "politics by other means." Targets with symbolic significance like government buildings and special events are particularly attractive. This was demonstrated by the Oklahoma City bombing, the Munich Olympic Games, and the Atlanta Olympic Games. Terrorists wish to get immediate publicity for their cause. Any attack in Las Vegas, the world's center for tourism, would receive extensive media coverage. This problem will increase in the future as Las Vegas adds new events, such as race tracks, major sports teams and so on.

Other aspects of the region deserve mention in any discussion of the symbolic value of examining terrorist activity. The first aspect is the nature of the Nevada Test Site (NTS), which partly contains Yucca Mountain. The DOE conducted approximately 1,000 nuclear tests at the site from the 1950's to the late 1980's. These tests became extremely controversial and incited protest marches and acts of civil disobedience. Even without nuclear testing, the NTS remains a lightning rod for opponents of nuclear power as well as nuclear energy. It provides antinuclear groups with a powerful raison d'Etre and ensures the likelihood of an ecoterrorist attack on shipments through the regional remains a real possibility.

The second aspect of Clark County's symbolic value is due to the controversial nature of its economy. The symbolism of killing Americans in their most famous tourist community makes Clark County a much more attractive target. The Las Vegas Convention and Visitors Authority (LVCA) has surveyed peasants in India and found that they were aware of two cities in the US New York and Las Vegas. Las Vegas may be regarded as anathema by fundamentalist regimes in the Muslim world because it represents everything that is corrupt and sinful about the West. Clark County's symbolism is an important characteristic that should be examined by the DEIS.

Military Facilities

Nellis Air Force Base, its auxiliary facilities, and the Nevada National Guard armored cavalry squadron (1" Squadron/221st Cavalry) provide options for a terrorist group to distract local law enforcement, or to divert weapons useful in an attack on a shipment.

The close proximity of these facilities to several of the implementing alternatives for transporting the waste increases the likelihood that a terrorist group would favorably view this area for a coordinated series of terrorist events. These facilities also assist in the response to and the mitigation of a terrorist attack. The benefits of these facilities should be assessed. In that assessment should be some analysis of how well they have been integrated into local emergency response planning.

Methods and operational Considerations

The DEIS' treatment of terrorism relies on incomplete analysis of the ways in which terrorists are likely to attack. Both the methods and the operational characteristics of a terrorist attack should be examined.

Methods

The weapon used by terrorists to attack a shipment of nuclear waste is an important issue that the NRC has agreed to reconsider. The NRC [Nuclear Regulatory Commission] has rightly concluded that it must reexamine the threat defined in its 1984 rulemaking. The DEIS accepted the Sandia National Laboratory's 1984 and 1999 reports that evaluated the damage to a canister using a military MW demolition charge. The State of Nevada has argued that more sophisticated anti-tank weapons should be considered potential threats. Clark County agrees with this and recommends the NRC examine a terrorist scenario in which the terrorists are equipped with a TOW II or Milan antitank missile or a car bomb as their primary weapon. As the FBI's 1996 report stated:

"The threat at the lower end of the spectrum is likely to grow as well. The M-16, M-10, Uzi and AK-47 assault rifles will be supplemented by standoff weapons like Stinger antiaircraft missiles, LAWs and RPG-7s, already available on the world weapons market. Just because a weapon is relatively unsophisticated does not mean it cannot cause massive casualties. A stinger missile aimed at a jumbo jet as it takes off or as it approaches a large metropolitan airport could cause tremendous casualties. A LAW or RPG round lobbed into the right area of a nuclear power plant could produce catastrophic consequences."

These standoff weapons provide the opportunity for highly flexible hit and run attacks. Either of these types of weapons would be more realistic than the cratering charge in the current scenario. A review of terrorist activities reveals that the antitank missile and car bomb are favorite weapons of terrorists and are likely to impose greater strains on the canisters than the M3AI cratering charge currently being considered.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Cask safety features that provide containment, shielding and thermal protection also provide protection against sabotage. The casks would be massive. The spent nuclear fuel in a cask would typically be only about 10 percent of the gross weight; the remaining 90 percent would be shielding and structure.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of a saboteur using a high-energy density device on a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (9635)
Comment - EIS001888 / 0303
Civil Disobedience

As a subset of terrorism, the problem of Civil disobedience is another area in which the DEIS should have made some statement. The transportation of spent nuclear fuel to the Gorleben facility in Germany has touched off numerous annual riots. These riots have resulted in the destruction of infrastructure and deliberate efforts to prevent the transportation of waste. The Nevada experience with civil disobedience is long and centered on opposition to the Nevada Test Site. To date, the protestors have refrained from acts of violence; however, the decision to store HLW [high-level radioactive waste] in Yucca Mountain could be viewed by some radical groups as illegitimate. It is possible that an ecoterrorist group could, while "monkeywrenching" the transportation of spent fuel, inadvertently cause a more severe accident to occur. Certainly, the DEIS must consider the possibility of civil disobedience as an impact.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

DOE relies on local authorities to maintain order and DOE anticipates that the safeguards and security plans for the shipments would include whatever measures necessary to protect the shipments from any threat and ensure that they reach their destination. Appendix M of the EIS provides additional information on transportation safeguards and security requirements.

8.10.1 (9636)
Comment - EIS001888 / 0304
In order for the DEIS to be regarded as a credible document, it is important that certain modifications be made that will ensure the DEIS has properly addressed the problem of terrorist attacks on HLW [high-level radioactive waste] casks. These are:

The DEIS should contain a safety assessment that discusses the relative security of shipping waste via dedicated trains and general freight. The safety assessment should also compare the safety of transporting the waste via dedicated train and truck.

The DEIS should examine the implications of advance approval of truck and rail routes. Security considerations should be incorporated into rail and truck routes selection and RADTRAN modeling should be performed for alternative security scenarios to assess the relative benefits of security considerations.
The DEIS should examine the safety implications escort requirements to include more than a single driver as a possible escort.

The DEIS should discuss the types and character of the terrorist threat likely to effect the proposed action. Civil disobedience should also be included in that discussion.

The DEIS should report on the vulnerability and utility of local military facilities to likely terrorists.

The DEIS should relate the security of waste shipments to the demonstrated and published techniques used by terrorists.

The DEIS should report the results of a full-scale test of the effects of a TOW II missile impacting obliquely on a GA-4 cask from a range of 1,000 meters.

Response
Transportation shipments by dedicated trains, general rail freight, and truck would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

The safeguards requirements for general freight and dedicated train shipments are the same. Dedicated train and truck requirements are generally the same, with the exception of escort requirements, which acknowledge the difference between the transport modes. In response to comments, DOE has added information on transportation safeguards and security measures in Section M.7 of the EIS.

8.10.1 (9758)
Comment - EIS001888 / 0342
[Clark County summary of comments it has received from the public.]

Several commenters requested that the EIS evaluate the implications of transport and disposal of SNF [spent nuclear fuel] and HLW [high-level radioactive waste] on national security, terrorism, and proliferation of nuclear weapons in the U.S. and abroad. Mechanisms that preclude terrorism and proliferation also should be addressed by the EIS.

Response
DOE prepared the EIS to complete the mandate of Congress. Part of the reason to develop a repository would be to dispose of these materials permanently to protect the public health and safety and the environment, including to remove the material from potential diversion and terrorist acts.

8.10.1 (9942)
Comment - EIS001732 / 0011
What safeguards will be in place during the shipping and storage process in case of failed equipment; for instance, O-ring failure as in the TMI [Three Mile Island] case, human error as when a buffer car with a TMI fuel train was labeled as containing calcium carbide, an explosive compound, vehicular accidents such as the accident involving a citizen's car which stalled on the tracks here in St. Louis and was hit by the TMI train, or sabotage? Unfortunately, terrorism is an increasing reality in today's society and must not be ignored, and let me say here, terrorists are very innovative people.

Response
Quality assurance procedures would be in place to minimize the kind of errors cited in this comment, but there is still a chance that errors could occur. However, errors of this sort would require another accident or incident to occur to trigger any effect. The likelihood of a simultaneously occurring event is very low, but even if that occurred, the casks are extremely robust and would survive very severe events.

Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (10021)
Comment - EIS001888 / 0515
[Clark County summary of comments it has received from the pubic.]

DOE's Developing the Transportation Plan is now in EIS and has no focus on security (i.e., guards) for shipments.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. One of the specific requirements in 10 CFR 73.37 is that armed escorts would be required in heavily populated areas that are generally defined as urban areas with a population of 100,000 or greater. Additional information on physical protection of shipments can be found in Appendix M of the EIS.

8.10.1 (10032)
Comment - EIS000657 / 0002
Another thing that bothers me is this transportation thing. We've dwelt on that a great length.

One that I think that boggles my mind, if one of those trains goes through a big city like Denver, Salt Lake City, or Las Vegas and some terrorist dropped a missile on that thing, ain't no way in the world you're going to clean that thing. It's impossible.

Response
The EIS discusses sabotage during transportation in Section 6.2.4.2.3. Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the

maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (10033)
Comment - EIS000809 / 0004
Transportation Security-From the data presented in the EIS, it appears that acts of sabotage greatly increase the risk of concentrated releases of nuclear material. Our concern in this area emanates from the number of stated shipping points. All told, there are a total of 77 separate shipping points. We know that transportation security is fairly consistent within the DOE. However, we would like to have the assurance that transportation security will be treated uniformly from all 77 shipping points and that the DOE will have ultimate responsibility for the security of all such shipments.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. Because DOE would conduct the shipments according to Nuclear Regulatory Commission requirements and Departmental directives, there would be little variation in the process for shipments from the 77 sites.

Although it is not possible to predict the types of potential sabotage events with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of sabotage against a truck or rail cask. The results of this analysis indicate that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (10053)
Comment - EIS001877 / 0009
DOE should incorporate terrorism/sabotage risk management and countermeasures in all DOE transportation plans relating to operation of a repository, interim storage facility, and/or intermodal transfer facility, including liability for costs and damages resulting from terrorism/sabotage against nuclear waste shipments.

To date, DOE has said that it would rely on regulations and the security oversight of the Nuclear Regulatory Commission to ensure the safety of its OCRWM [DOE Office of Civilian Radioactive Waste Management] shipments. No commitments to extra-regulatory measures have been made.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

In addition, 10 CFR 63.21 requires a repository at Yucca Mountain to have physical protection consistent with 10 CFR 73.51. This regulation specifies a performance objective, which provides "high assurance that activities involving spent nuclear fuel and high-level radioactive waste do not constitute an unreasonable risk to public health and safety." The regulation requires that spent nuclear fuel and high-level radioactive waste be stored in a protected area such that:

- Access to the material would require passage through or penetration of two physical barriers. The outer barrier would have isolation zones on each side to facilitate observation and threat assessment, would be continually monitored, and would be protected by an active alarm system.

- Adequate illumination would be provided for observation and threat assessment.

The area would be monitored by random patrol.

- Access would be controlled by a lock system and personnel identification would be used to limit access to authorized persons.

A trained, equipped, and qualified security force would be required to conduct surveillance, assessment, access control, and communications to ensure adequate response to any security threat. Liaison with a response force would be required to permit timely response to unauthorized entry or activities.

Because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments and key facilities. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (10918)
Comment - EIS000241 / 0005
In a recent study in which they took the early experimental results and applied them to modern casks, and again, as I said, we have calculation tools to do this now as a result of the scale model and full-scale testing we've done, you apply these to the existing casks today.

It turns out that the result of a sabotage event is still well within the kinds of environmental impacts, including impact to the public, that you would find acceptable. The latent cancer fatalities are somewhat less than 1 in 100, or 1/100th of one latent cancer fatality.

The other thing that isn't factored into those kinds of considerations is the fact that these munitions are not easy to use. And two things determine the effectiveness of these munitions. They're shaped charges. They're the kind of things the Army uses as bazookas. One of these factors is called obliquity, which means that the shaped charge has to hit the surface of the cask at 90°. If it hits as little deflection as 10°, then the jet is deflected off, and it doesn't penetrate.

Now, in both cases, the rail cask and the concrete cask, the sides of the cask are such that that area of the cask that you can hit and be successful in poking a hole in it is quite small.

Furthermore, these weapons, if you're going to use a launcher to fire them, it's incredible. The closer you are, the more likely you are to miss, because the flight of the projectile is very erratic when it first comes out of the launch tube. It's only at ranges of about 100 yards that the flight becomes predictable, where the person firing it can actually aim it at something and have a fair chance of hitting it.

But at 100 yards you're trying to hit a band on a cask that's maybe four inches wide, maybe six inches wide at the most. And so the likelihood of satisfying the obliquity requirements are very, very low.

Secondly, there is a requirement for this kind of munition to be detonated at a precise distance from the surface it's trying to penetrate. In these shoulder-launch devices there is a nose cone on there that provides you with that standoff distance, and the fuse is in the nose cone. So when it touches the surface, everything goes off.

The only problem is that these have personnel barriers around them, and so that is what the nose cone is going to hit, and you have defeated the munition simply because of standoff distance.

Now, there is a possibility, if you want to entertain it, that that person's intent on causing this damage could gain physical control of the unit and, in fact, set the system up so it is optimal in its capability for destroying the cask.

Understand, though, that there is a button in the truck, in the cab of the truck, so that if the driver senses any sort of interdiction, he presses the button and red lights go off in all of these control centers all over, and response to the system is quite good, quite quick.

So it takes time for the saboteur to set up the conditions he wants and to detonate his device. And in the meantime, you've got all the resources that we've got coming down on him, and that does not make it a very attractive target for a saboteur.

Response
The EIS discusses sabotage during transportation in Section 6.2.4.2.3. Although it is not possible to predict the types of potential sabotage event with certainty, DOE has examined various accident scenarios, which can provide a sense of the consequences that could occur in such events. In addition, DOE has specifically analyzed the potential consequences of a saboteur against a truck or rail cask. The results of this analysis indicated that the maximally exposed individual would increase the risk of incurring a fatal cancer from approximately 23 percent (the current risk of incurring a fatal cancer from all causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

However, because of the attacks on September 11, 2001, DOE and other agencies ar reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (11120)
Comment - EIS001207 / 0009
Although DOE Yucca Mountain Site office cannot intervene in local political manipulation of democratic process, it must acknowledge that trusting local levels to implement NEPA [National Environmental Policy Act] and democratic process is, at times, trust misplaced. Unethical actions and illegal actions have recently been subject of criminal and civil investigations within the region of Ohio and Kentucky considered by DOE as transport corridors for HLRW [high-level radioactive waste] (and surplus nuclear weapons arsenal materials). DOE must consider recent regional examples of conduct (and lack of concern) which could potentially place the general public at considerable risk during transport of nuclear materials through regional transportation corridors.

Lewis County of Kentucky Grand Jury recently indicted an individual believed to be connected to a multi-state, semi-trailer theft ring. The man was from Lucasville, Ohio. Further investigation is continuing with charges expected against a man from Piketon, Ohio (location of the Portsmouth Gaseous Diffusion Plant). See Attachment V, "First Charges Brought in Theft Ring Investigation," THE LEDGER INDEPENDENT, January 25, 2000, pg. A-1. The point here is rather obvious, transport of materials to the Yucca Mountain Site may not be as "secure" as DOE would seem to believe in agency calculations regarding risk assessment from accident, "incident" or theft.

Response
The safety and security of spent nuclear fuel shipments is the responsibility of DOE. DOE would ensure that the contractors making the shipments follow all DOE and Nuclear Regulatory Commission safeguards requirements.

Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

8.10.1 (11220)
Comment - EIS001729 / 0002
With respect to terrorist assault, I find that the casks are adequately designed to protect against what I would call any expected terrorist assault, but quite frankly, I believe that these packages are not even on the list of anyone who's interested in sabotage or terrorism. They are a target of low opportunity with a very low probability of having any effect and there are far more targets of opportunity, and no one in St. Louis or any other place in the country ought to be worried about it, that particular aspect of the movement of fuel. We've done it. We've been there, done that, as the expression goes. We know what we're doing and we will continue to do it safely in the future.

Response
The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection and safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the physical protection and safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. The cask safety features that provide containment, shielding, and thermal protection also provide protection against sabotage. The casks would be massive. The spent nuclear fuel in a cask would typically be only about 10 percent of the gross weight; the remaining 90 percent would be shielding and structure. Additional information on the physical protection of spent nuclear fuel and high-level radioactive waste during transportation can be found in Section M.7 of the EIS.

It is not possible to predict whether sabotage events would occur, and if they did the nature of such events. Nevertheless, DOE examined various accidents, including an aircraft crash into a transportation cask. The consequences of both the maximum reasonably foreseeable accident and the aircraft crash are presented in the EIS for the mostly truck and mostly rail transportation scenarios and can provide an approximation of the types of consequences that could occur from a sabotage event. In addition, DOE analyzed the potential consequences of sabotage against a truck or rail cask (see Section 6.2.4.2.3 of the EIS). The results of this analysis indicate that the risk of the maximally exposed individual incurring a fatal cancer would increase from approximately 23 percent (the current risk of incurring a fatal cancer from all causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the terrorist attack of September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.1 (11503)
Comment - EIS002137 / 0004
We talk about terrorism. Somebody mentioned terrorism. Why would you want to attack a -- a cask full of spent fuel rods? Right out here at Nellis Air Force Base, we have 1,450 nuclear devices. If you want to shoot a missile at something, that ought to light our fire. We don't see anybody saying, "How long are they going to last, 10,000 years?" They got there. They got there on B-52s, they got there with trucks.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. Assessing the vulnerability of military bases to terrorist attacks is not within the scope of this EIS.

8.10.1 (12134)
Comment - EIS001887 / 0436
Improper Attention to Sabotage and Terrorism Scenarios

2.1 Inadequate Selection of "Reference Weapons"

2.1.1 The 1999 Sandia Study (Luna et al) needs to be more specific on what type of device it selected for computer simulation. Although the report claims that the vagueness was necessary to prevent the document from being classified, it is necessary to provide more details so a thorough analysis of its findings can be performed. This is the only way to test the validity of the computer simulations used in the report.

2.1.2 The DOE needs to make clear exactly what range of devices is available for consideration as "reference devices." It is our belief that devices such as the Milan Anti-Tank Missile and the US TOW 2 Anti-Tank missile, reported to have armor-penetrating capabilities of great than 1000mm (39.4 inches) and greater than 700mm (28.5 inches), respectively, must be considered (Norris).

2.1.3 All Sandia reports considering sabotage implicitly assume that a terrorist attack will involve a single strike using a single charge or missile. However, some devices can be fired multiple times in quick succession: the US TOW 2 can be fired up to three times in 90 seconds (Norris, Halstead & Ballard). The DOE needs to address the potential for a multiple-strike terrorist attack, which is likely to cause significantly more damage then the scenario modeled in the Sandoval and Luna reports.

2.2. Improper extrapolation of previous experiments to current cask designs

2.2.1. Use of "Swept Volume" as a surrogate for fraction or respirable material released

2.2.1.1. The equation listed in the Luna report which attempts to define a "swept mass" solely in terms of the geometric properties of the hole left by the charge does not balance its units. This will be analyzed in detail in the Review Comments. If this equation turns out to be invalid, the entire analysis performed in the Luna report and cited in the EIS becomes irrelevant, requiring a completely new analysis. Until this is addressed the results correlating swept volume and respirable aerosol production cannot be trusted.

2.2.1.2. The relationship assumes that there is only one hole into the fuel cask (i.e., an entry hole but no exit hole). Multiple holes will significantly increase the amount of respirable material released (Luna estimated it to be by a factor of 10). Due to the possibility that certain weapons can completely penetrate a cask, or that a cask will be penetrated by multiple shots, any relationships relying on a single hole entry into the cask is not credible as a worst Case scenario.

2.2.1.3. The "one hole assumption" results in another underestimation of the fraction of respirable aerosol produced by the oxidation of UO_2. Assuming a cask is fully penetrated, this will create a flow of oxygen into the cask, which will result in the oxidation of UO_2 to U_3O_8, a fine powder of mostly respirable particles. This oxidation rate is increased significantly at temperatures above 250ºC (Aronson). Temperatures this high will be likely in the event of a missile strike coupled with a fire. This significant source of respirable aerosols was not accounted for in the Luna correlation exercises.

2.2.1.4. Using a geometric correlation assumes that all casks, and all devices used in an attack, will exhibit the same thermal properties as the cask in the Sandoval experiments. Since the thermal properties of uranium are very different from lead, this will not be the case. Because of this, it is not enough to simply assume a relationship between aerosol released and swept volume, and use this to estimate releases in unrelated casks. This ignores thermal mechanisms of aerosol generation, such as oxidation of UO_2 under elevated temperatures. Further, different attack devices will impart a different amount of heat into the cask, resulting in different aerosol production rates as a function of thermal input. This will be likely to change to relationship between swept volume and aerosol released, making any correlation attempt between different casks or different devices trivial.

2.2.2. Estimation of respirable aerosol produced due to breach of pressurized rods

Luna cited irrelevant data to estimate the amount of surrogate fuel aerosol that could be created within the cask and released in the event of breach. The cited experiment showed a linear relationship between the energy density in the material from the impact of a calibrated hammer on brittle objects and mass of particulate material having diameter smaller than 10μm. However, the materials chosen were refractory to ensure that melting and vaporization were not observed. In the event of a missile strike, temperature effects are likely to be extremely significant. Therefore, any study that tries to estimate aerosol production as a function of energy density, but does not include temperature effects, is irrelevant and should not be used. Because of this, the estimate of 5% aerosol production due to HEDD [high-energy density device] impact is not accurate or conservative. It may do better to assume that all of the uranium mass not accounted for in the Sandoval studies (assumed to be inside the cask and deposited on its walls) was of respirable size and able to be expelled in the event of cask compromise. This will significantly alter the consequence analysis, since about 1% of the total UO_2 mass, and 37% of the mass released from the pins, was "unaccounted for" in the Sandoval full-scale experiment. A direct measurement of the amount of material deposited inside the cask walls is necessary to estimate how much aerosol is produced due to HEDD action. Therefore, a new study is recommended with more complete sampling procedures in order to obtain an experimental value for the respirable aerosol production due to the HEDD. The 5% value assumed is likely to be low.

2.2.3. Unsubstantiated reduction in the spent fuel-surrogate fuel ratio

Luna attempts to reduce the value used by Sandoval which accounts for the fact that spent fuel will produce more respirable aerosols then the surrogate fuel used in most experiments. Luna quotes the following experimental estimations of this ratio: .53, 5.6, .71, .42, 3, 2.8, 2.5, 3, 12. From this, it is estimated that 3 is the most appropriate ratio, even though the range of experimentally-determined ratios differs over 3 orders of magnitude. Further, after Luna (correctly) dismisses all values less than 1.0 as implausible, it would make sense to use the largest cited value for a conservative approximation. Alternately, the geometric mean of a large distribution of numbers is often used for estimation purposes (a value of 4 in this case), so long as a range based on the standard deviation about the mean is given as well.

However, more likely is that the large distribution of estimated ratios suggests that there is no clear, reproducible relationship between the amount of spent fuel and surrogate fuel aerosols produced from a blast of given intensity. Thus, it is argued that no ratio is acceptable. Rather, the inconsistent data suggest that the only way to determine spent fuel response to a detonation is to detonate a cask containing spent fuel and analyze the results. Short of doing this, the correlation used by Luna is arbitrary, non conservative, and unacceptable.

2.3 SCAP computer code used without sufficient benchmarking

The Luna study attempts to utilize a computer model as a replacement for actual experimentation in order to determine the possible damage caused by two HEDD's on state-of-the-art shipping casks. However, the code that they use admittedly does not model multi-layered targets well. The Luna study "benchmarks" the SCAP code against the Sandoval full-scale test and determines that the code predicts penetration depth well, but underestimates the size of the hole created by the penetration. In an attempt to remedy this, the Luna report multiplies the predicted hole size by a factor of 2.0 to obtain "correct" results, then proceeds to do the same when modeling other cask designs. This approach is seriously incorrect. It assumes that the code will consistently model all cask layer or shell arrangements, including different numbers of layers, which is incorrect. With no experimental data to prove this, this assertion is unacceptable. It cannot be assumed that a computer code which, when used to model multi-layered targets could result in "serious difficulties in comparing SCAP modeling output and experimental data" (Robinson), would be expected to model, for example, a lead-steel interface with the same degree of incorrectness as a lead-uranium interface. Therefore, until an experimental proof of the merits of using the SCAP code to model the behavior of a shaped charge strike on a uranium-shielded cask is performed, the code cannot be considered validated. Further, since the code underestimated the true size of the hole in the Sandoval experiments, it cannot be assumed that this code will provide a conservative approximation of penetration damage. This leads to the call for a full set of experiments designed to determine the true effect of a HEDD explosion on cask integrity.

2.4. Omission of two important sabotage scenarios

2.4.1. Nevada intermodal transfer station sabotage event

The EIS, on pg. J-95, states that section J.1.5 evaluates the effects of sabotage on intermodal transfer stations. However, there is no section J.1.5, and there is no mention of this potential sabotage event again. It is essential to perform an analysis of the likely effects of a successful sabotage event on an intermodal transfer station because of its unique conditions. For one, shipping casks at an intermodal station will be stationary. This eliminates some of the problems associated with striking a moving target optimally that were presented in the EIS. Also, this makes the possibility of a multiple Cask release possible. Third, the appeal among potential saboteurs of attacking a station rather than a truck or train must be addressed. Intermodal transfer will also occur at reactor sites without rail access. All of these factors suggest that the potential for sabotage at an intermodal station must be addressed in a comprehensive manner.

2.4.2. Barge transport sabotage event

The EIS does not consider the consequences of a possible sabotage event on a barge shipment of spent nuclear fuel. As this is one of the transportation options being considered, it is important to consider the effects of a successful sabotage event, including the breach of shipping casks and release of radioactive material into the air and water, especially near populated areas, water supplies, or natural environments. It is essential to address this concern, especially since there was no discussion of the consequences of severe barge accidents, which were determined by the EIS to be not reasonably foreseeable.

2.5. Failure to identify/profile potential "Threat Groups"

It would be helpful to provide some general profiles of potential "Threat Groups" in terms of characterizing exactly what these groups are capable of doing, and the relative likelihood of each group performing a sabotage act. This would help in determining what types of weapons, forces, expertise, etc can be expected to be utilized by different groups, providing the DOE with a better estimate of what safeguards must be put in place. The Final Environmental Impact Statement: *U.S. Spent Fuel Policy, Storage of Foreign Spent Power Reactor Fuel* (1980: DOE/EIS-0015) provides a list of "Threat Groups" to nuclear fuel storage and transportation; a similar, but updated list would be helpful.

2.6. Improper dismissal of considering the probability of terrorist events

The EIS and the Luna report both consistently state that, since sabotage events are not randomly occurring, no estimation of their probability can be made, other than assuming they are "extremely rare." However, some comment should be made concerning the increase in large-scale terrorist attacks and how this relates to the need for sufficient safeguards against such attacks. Even though attacks are not random events, some effort should be made to identify trends, such as the increase in attacks on American soil over the last few years. This provides a proper foundation through which to analyze the level of protection required from terrorist attacks.

2.7. Failure to present a true "worst case scenario" for consequence analysis

2.7.1. Use of "averaged" wind conditions instead of wind blowing in one direction

The inputs used by the DOE in determining health effects of a successful sabotage scenario assume generalized wind conditions. For a true worst Case scenario, the impact of a radiological release directly downwind from a large population center, such as an office building, prison, stadium, etc. must be addressed. The use of wind conditions averaged over all directions dilutes the effect of a single-direction wind event.

2.7.2. Use of "average" (neutral) weather conditions, instead of worst Case conditions

The EIS states that, because the time and place of a sabotage event cannot be predicted, average weather conditions for the entire United States must be used. However, it seems likely that potential saboteurs will, to the degree

feasible, plan sabotage events around those weather conditions that are the most damaging. Thus, for a true "worst case" sabotage scenario, weather conditions leading to the greatest consequences should be used.

2.7.3. "One bullet assumption"

As has been previously discussed, the consideration of only a single HEDD strike in the simulation of a sabotage event is unrealistic. Terrorists who are serious about causing a significant release of radioactive material, and who have the means of obtaining armor-penetrating weaponry, will likely bring a complete arsenal, including several armor-penetrating devices, incendiary devices, etc. Therefore, cask response to multiple missile penetrations, especially if they are fired in succession such that missiles strike an already damaged cask, must be addressed. It is extremely likely that the damage done to an already-penetrated cask will be substantial. This has not been assessed by the DOE and must be in order for the sabotage portion of the EIS to be considered complete.

2.7.4. Failure to consider effects of breached cask coupled with long-duration fire

The EIS assumes that there will be no significant secondary effects on the cask after missile impact, since the casks themselves are not flammable. However, the trucks and trains carrying them are flammable. Further, there is the possibility of deliberately causing a fire, either by truck bomb or other method, to intensify the damage from a penetrated cask. This scenario must be taken into account.

2.8. Failure to assess social, psychological, environmental, or economic costs

In order to be able to truly assess the consequences of a successful sabotage event, the full scale of effects must be studied. The DOE has commissioned studies addressing the psychological impacts of radiation accidents on the public, but similar studies have not been performed for this EIS. In addition, no consideration of the cost of cleanup of such an event is given. Below is a skeleton outline of the various factors not considered by the EIS that need considerable attention.

2.8.1. Social/psychological costs not addressed
2.8.1.1. Increased fear of nuclear energy, and nuclear industry
2.8.1.2. Fear of vulnerability to attack (see Oklahoma City bombing)
2.8.1.3. Susceptibility of foreign-born citizens to discrimination
2.8.1.4. Distrust of government that transports materials capable of such destruction

2.8.2. Environmental costs not addressed
2.8.2.1. Groundwater and/or surface water contamination →more human costs
2.8.2.2. Loss of land use near site for significant amount of time

2.8.3. Economic costs not addressed
2.8.3.1. Cleanup costs
2.8.3.2. Decontamination costs
2.8.3.3. Lost workdays due to radioactive contamination of roads, buildings, etc.
2.8.3.4. Loss of tourism in Las Vegas, for example, due to contamination or fear
2.8.3.5. Evacuation costs
2.8.3.6. Relocation costs

Response
This response answers each point using the paragraph numbers from the comment.

2.1 Inadequate Selection of Reference Weapons

2.1.1. Within the scope of its classification policy, DOE can offer no more specific information about the devices considered in Luna, Neuhauser, and Vigil (DIRS 104918-1999).

2.1.2. Within the scope of its classification policy, DOE cannot state specifically which devices the analysis considered. However, the analysis enveloped the damage that modern weapons might produce in an optimally successful sabotage event.

2.1.3. DOE believes that its analysis adequately bounds the sabotage consequence scenario.

2.2 Improper Extrapolation of Previous Experiments to Current Cask Designs.

2.2.1.1. The commenter makes a valid comment with regard to the equation in the report for swept volume. It is incorrect as printed; the number of rows of pins along the disruption path (NR) should not be divided by the pin pitch (PP), and NR should therefore be unitless. The actual calculations in the report were rechecked and found to be correct.

2.2.1.2. While multiple holes could lead to an increased release fraction, as suggested by this comment, the result is unlikely to be additive of the results for a single hole presented in Luna, Neuhauser, and Vigil (DIRS 104918-1999). This is because the driving pressure from rod pressurization postulated to enhance the release fraction over that measured by Sandoval et al. (DIRS 156313-1983) would be lower for each successive attack as the number of undamaged fuel pins became smaller. Without a mechanism for producing a strong gas flow out of the cask, respirable material probably would plate out on the huge surface area in the cask.

The assertion that modern weapons can produce full penetration of both cask walls is not confirmed by calculations from Luna, Neuhauser, and Vigil (DIRS 104918-1999).

2.2.1.3. This comment suggests that multiple holes would allow a flow of air into the cask that would enable exposed UO_2 to oxidize to U_3O_8, which is asserted to be a fine powdery material, when temperatures exceeded 250ºC (482ºF),. While the oxidation process could occur, achieving temperatures of 250ºC to make the process occur quickly could not occur easily. Penetration by the weapon would not increase temperature noticeably inside the cask, and fires would take some time to produce enough heat into the cask to raise temperatures above 250ºC. Moreover, conversion to U_3O_8 in the cask does not mean that particles would escape from the cask or that they would be small enough to become a significant health hazard. Because this scenario requires even more aspects of the sabotage event to proceed perfectly, it becomes increasingly unlikely.

2.2.1.4. The thermal properties of shielding material have little effect on the predicted geometry of penetration from use of a high-energy-density device (HEDD). Penetration is unrelated to thermal effects; it is related to density, depth, and to some extent, strength of the materials with which the device would interact. Thus, the use of swept volume scaling to estimate aerosol production is a reasonable approach. As indicated in Luna, Neuhauser, and Vigil (DIRS 104918-1999), the SCAP computer code predicted penetration depth closely in two very different configurations involving different materials. There is good confidence that penetration estimates in lead, uranium, and fuel are sufficiently accurate for the analysis performed and for the estimate of swept mass.

Since the publication of the Draft EIS and Luna, Neuhauser, and Vigil (DIRS 104918-1999), additional data has become available in a paper by Luna (DIRS 157201-2000). This paper describes three experiments in which an unspecified HEDD penetrated a ductile cast-iron CASTOR cask containing nine mocked-up pressurized-water reactor fuel assemblies. Each assembly was made up of pressurized fuel rods filled with unirradiated fuel pellets. Two experiments were substantially the same. Each yielded a respirable release exterior to the cask of about 1 gram of aerosol. A third experiment was done with the cask interior at a pressure of 0.8 atmosphere, which yielded a release of about 0.3 gram of respirable aerosol. These releases include the cask purging effect of the release of rod plenum gases. The experiment described in Sandoval et al. (DIRS 156313-1983) yielded a respirable release of 3 grams but included no rod pressurization to create a purging flow that would force additional respirable material out of the cask. The two results are close, but the conditions for each were different.

Luna (DIRS 157201-2000) used the swept mass concept to relate these experiments. The respirable release fraction scaled to swept mass for the first two experiments was about a factor of 2 smaller (DIRS 156313-Sandoval et al. 1983). Based on the CASTOR experiments that suggested that little of the aerosol in assemblies behind the first one penetrated was likely to find its way to the entry hole and be released, the fractional respirable aerosol release fraction was found to be quite close to the value for the Sandoval et al. (1983) experiment. This value includes the

effect of releasing rod pressurization gas. This suggests that scaling the release to swept mass is a workable concept for translating experimental results to other situations.

2.2.2. There are two assertions in this section. One deals with the experimental data used to extrapolate to a 5-percent respirable source term and seeks to discredit that estimate. The second assertion is that all material not specifically accounted for in Sandoval et al. (DIRS 156313-1983) should have been assumed to be respirable.

Experiments. The materials used in the experiments cited in Luna, Neuhauser, and Vigil (DIRS 104918-1999) were not "chosen to be refractory to ensure that melting and vaporization were not observed," as suggested. They were typical of spent nuclear fuel and other waste forms. This comment seems to separate temperature effects from energy density effects when, in fact, temperature and pressure are indicators of energy density and were included in the experiments used in the report. The work cited (hammer experiments) is not irrelevant to estimating the respirable particles produced, as suggested. In addition, this comment does not recognize that Sandoval et al. (DIRS 156313-1983) saw no evidence of melting or vaporization-generated uranium oxide aerosols in their experiments. Similarly, there were none in the hammer-related studies.

Respirable Particulate. Because the experiments in Sandoval et al. (DIRS 156313-1983) did not account for all materials in all volumes on all surfaces and there was potential for gas release from rods to move more respirable material from the cask to the environment, Luna, Neuhauser, and Vigil (DIRS 104918-1999) corrected the original source term estimate from Sandoval et al. (1983). This comment suggests that the 5-percent respirable estimate used for this purpose was too low and that a new experiment is needed. As stated above, a more recent experiment suggests that the original Sandoval et al. (1983) result was correct and that the 5-percent respirable aerosol estimate derived in Luna, Neuhauser, and Vigil (1999) might be an overestimate. DOE believes that the current analysis, based on past and recent experiments, provides a reasonable estimate of the potential consequences of a very unlikely event.

2.2.3. The spent nuclear fuel-to-surrogate fuel ratio is important in the estimation of the source term. The approach taken in Luna, Neuhauser, and Vigil (DIRS 104918-1999) was to use a value of 3 for the ratio, justified on the grounds that it was a central value. In fact, the mode of the values given is 2.8 and the median is about 2.6, which are other measures of central tendency for which a value of 3 is somewhat conservative. This comment suggests the use of a geometric mean value and estimates that value to be 4 (the actual geometric mean of the nine values given is actually about 2.1). The comment then suggests that the range is so wide that there is no reproducible relationship and DOE should perform a full-scale experiment with spent nuclear fuel. However, there is a body of data [of which the Jardine data used in Luna, Neuhauser, and Vigil (1999) are a part] that suggests that there is a definite relationship between particulate production and energy density in impacts in brittle solids. That being the case, there should be a reasonably well-defined relationship for aerosol production between various brittle materials like spent nuclear fuel and UO_2. The fact that it was too expensive to do many correlation experiments in the 1980s experiments does not mean that the relationship does not exist. The experiments performed suggest a central value of about 3, as used in Luna, Neuhauser, and Vigil (1999).

2.3 SCAP Computer Code Used Without Sufficient Benchmarking.

The application for which the SCAP code was used was well suited to its capability. The comment overlooked the three benchmarking calculations on a variety of cask and cask-like configurations. These calculations included the averaging of surrogate fuel and open space to represent fuel assemblies. The prediction of depth of penetration, which is a key issue in the analysis, was correct. The need to adjust the diameter predicted by the SCAP code by a factor of 2 seems preferable to using the predicted diameter and introducing a known underestimate. This normalization is not likely to introduce major unconservative errors in the analysis.

2.4 Omission of Two Important Sabotage Scenarios

The commenter identifies two additional scenarios, which involve an intermodal transfer station and barge transport. Spent nuclear fuel casks at an intermodal transfer facility would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules aimed specifically at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR Part 73), these security rules are distinguished from other regulations that deal with issues of safety affecting the

environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under the control of unauthorized persons.

DOE considered barge transport sabotage scenarios in Appendix J of the EIS. While there could be the opportunity for a radiation dose from releases to surface water as a result of a barge accident or sabotage, the consequences are likely to be much less than releases to the atmosphere (DIRS 157052-Ostmeyer 1986).

1.5 Failure to Identify/Profile Threat Groups

The threats that spent nuclear fuel shipments must be protected against are known as "Design Basis Threats." Design basis threats are defined in 10 CFR Part 73. Profiling of threat groups is beyond the scope of this EIS.

Improper Dismissal of Considering the Probability of Terrorist Events

With regard to the probability of terrorist acts, because of the attacks on September 11, 2001, DOE and other agencies are reexamining the protections built into their physical security and safeguards systems. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

1.6 Failure to Present a True Worst-Case Scenario for Consequence Analysis

An EIS is not required to present a "true worst-case scenario" because the Council on Environmental Quality rescinded the requirement to perform a worst-case analysis in an EIS in 1986 (51 *FR* 15618, April 25).

2.7.1 Use of Averaged Wind Conditions Instead of Wind Blowing in One Direction. The atmospheric data used in the sabotage analysis was a joint frequency of wind speed and stability class. As suggested by this comment, the wind was assumed to blow toward the population, and consequences were estimated for an urban area.

2.7.2 Use of Average (Neutral) Wind Conditions, Instead of Worst-Case Conditions. As mentioned above, the Council on Environmental Quality rescinded the requirement to perform a worst-case analysis in an EIS in 1986 (51 *FR* 15618, April 25).

2.7.3 One-Bullet Assumption. As discussed above, while multiple holes could lead to an increased release fraction, as suggested by the commenter, the result is unlikely to be additive. This results because the driving pressure from rod pressurization that was postulated to enhance the release fraction over that measured in Sandoval et al. (DIRS 156313-1983) would be lower for each hole as the number of undamaged fuel pins got smaller. Without a mechanism for producing a strong flow out of the cask, respirable material within the cask would be likely to plate out on the huge surface area within the cask. Thus, DOE believes that it has adequately bounded the sabotage consequence scenario.

2.7.4 Failure to Consider Effects of a Breached Cask Coupled with a Long-Duration Fire. It is possible that a sabotage attack could involve fires. Whether the fires could enhance the consequences would depend on their locations in relation to the cask and duration. A fire collocated with the cask could cause a greater release of material, but that material would be transported aloft in the plume of smoke and become unavailable for causing radiological impacts near the cask. The additional dispersion from fire-generated turbulence would mean that radiological doses a kilometer (0.6 mile) or so downwind of the cask would be only slightly higher.

2.8 Failure to Assess Social, Psychological, Environmental or Economic Costs

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $270 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies

involving actual cleanup of radioactive materials contamination. Section J.1.4.2.5 discusses environmental restoration after a release of radioactive material. Social and psychological issues are discussed in Appendix N.

8.10.1 (12200)
Comment - EIS010485 / 0004
Given the September 11, 2001, hijacking of commercial jets, it is not difficult to imagine similar events taking place on our highways, irrespective of the claims made for the strength of the spent fuel/nuclear waste containers.

These possibilities are not [addressed] by the EIS.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. Nuclear Regulatory Commission safeguards rules require the capability to immobilize the cab or cargo-carrying portion of the vehicle, so that a hijacked truck could not be moved. Aircraft crashes into spent nuclear fuel casks are discussed in Section 6.3.3.1 of the EIS. This analysis showed that an aircraft crash into a spent nuclear fuel cask would not penetrate the cask.

8.10.1 (12359)
Comment - EIS010489 / 0003
As of September 11, 2001 I can't see how a plan to transport such toxic waste across our nation could even be considered. Not only would there be the nuclear power plants as terrorists' targets but in addition our highways and communities throughout our nation would become targets.

Response
Transportation shipments would be protected from sabotage. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection or safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the safeguards regulations are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons.

However, because of the attacks on September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

8.10.2 EMERGENCY RESPONSE

8.10.2 (114)
Comment - 89 comments summarized
Commenters stated that the Draft EIS did not examine what emergency response personnel, training, and equipment would be needed along transportation routes or what the specific impacts of a transportation accident would be. Commenters wanted to know who would respond in the event of an accident: would local responders be the first to arrive at the scene of an accident or would transport vehicles be escorted with a response team? Other commenters asked who would train people and what level of training would be received and when would the hospitals and personnel in their communities be trained and equipped to handle radiation victims. Others asked how long it would take to train all of the necessary personnel for a potential nuclear "catastrophe." Other commenters noted that heavy trucks would be used to haul the spent nuclear fuel and high-level radioactive waste and were concerned that most cities, towns, and villages would not have the equipment available to move these vehicles in the event of an accident.

A state public utility commission noted that it would be involved in providing the funds and technical assistance to the affected communities in its state, both in the routing process and in supplying funds to train emergency

responders. Another commenter noted that the emergency response training should be separate from the current Occupational Health and Safety Administration training requirements of first responders to hazardous materials incidents. Other commenters stated that training needed to be conducted early to allow local responders to learn what would be involved in responding to an accident and that no spent nuclear fuel or high-level radioactive waste should be transported until the infrastructure for proper containment, transportation, and safety response/community education was in place. Commenters were concerned that without the proper equipment and training, fatalities would increase among first responders and others. Others stated that, because DOE would avoid identifying specific routes, that would contribute to a lack of training for the emergency response crews along those proposed routes.

Response

As discussed in Section 6.2.4.2 of the EIS, accidents involving the transportation of spent nuclear fuel or high-level radioactive waste shipments could occur. However, of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. As a consequence, the likelihood that a first responder or other emergency personnel would become contaminated, even in very severe accidents, would be remote. The only expected radiological exposure of first responders would be from any gamma radiation and neutrons penetrating the shielding of the casks. These radiation levels would be low, easily measured, and controlled to meet the limits of Nuclear Regulatory Commission regulations. Additional information on cask safety and testing is provided in Section M.4. Additional information on emergency response following an accident is provided in Section M.5.

As described in Section M.5 of the EIS, as with any transportation accident, state and tribal governments have primary responsibility to respond to and protect the public health and safety in their jurisdictions in accidents involving radioactive materials. This includes providing, managing, and maintaining responsibility for emergency response capabilities. Although DOE would originally provide the funding, each state and tribe would determine how it would administer that funding. Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. The training would cover procedures required for safe routine transportation of these materials, as well as procedures for addressing emergency response situations. DOE would provide the assistance based on the training needs of the states and tribes, as they determined using a planning grant and based on availability of funds in annual Program budgets specified by Congress.

The schedule in the proposed policy and procedures for implementation of Section 180(c) of the NWPA (63 *FR* 23753, April 30, 1998) is designed to provide adequate time for training of first responders in advance of the first shipments. If there was a decision to proceed with the development of a repository at Yucca Mountain, shipping routes would be identified at least 4 years before shipments began and Section 180(c) assistance would be made available approximately 4 years prior to shipments through a jurisdiction. Based on interactions with stakeholders, DOE believes that this would be sufficient time for emergency responders to receive the training to prepare them to respond to an accident involving DOE shipments. See Section M.6 of the EIS for a discussion of the DOE Section 180(c) policy and procedures.

If there was an accident involving a shipment to the proposed repository, the first responders and response time would be the same as those for any transportation accident. The primary public health and safety issue would be emergency care for those involved in the accident and the safety of those who responded. As discussed in Appendixes J and M of the EIS, accidents involving a spent nuclear fuel or high-level radioactive waste shipment would be likely over the proposed shipping period. Most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not be likely to result in release of radioactive materials from the shipping casks.

In the unlikely event someone was contaminated as the result of an accident involving shipments to a repository, there are several means to deal with such incidences. The Department has several programs available to provide assistance to state, tribal, and local governments in response to radioactive material accidents. The Radiological Assistance Program, for example, provides trained personnel with equipment to evaluate, assess, advise, and assist in the mitigation and monitoring of potential immediate hazards associated with a transportation accident. As part

of the program, DOE maintains eight Regional Coordinating Offices across the country that are staffed 24 hours a day, 365 days a year. The staff consists of nuclear engineers, health physicists, industrial hygienists, public affairs specialists, and other personnel who provide field monitoring, sampling, decontamination, communications, and other services, as requested. In addition, DOE's Radiation Emergency Assistance Center/Training Site (REAC/TS) focuses on providing rapid medical attention to people involved in radiation accidents. REAC/TS maintains a 24-hour response center to provide direct support, including deployable equipment and personnel trained and experienced in the treatment of radiation exposure, to assist Federal, state, tribal, and local organizations.

Recovering 23-metric-ton (25-ton) truck casks or rail casks weighing up to 140 metric tons (150 tons) loaded with spent nuclear fuel would involve methods commonly used to recover heavy trucks following truck accidents or railcars and locomotives following rail accidents. Capability to lift such weights exists for rail and truck modes and would be deployed as required. Railroads use emergency response contractors with the capability to lift derailed locomotives that could weigh as much as 140 metric tons.

At this time many years before shipments to the proposed repository at Yucca Mountain could begin, DOE is not ready to make decisions on which specific transportation routes would be used for shipping spent nuclear fuel and high-level radioactive waste. The routes used in the EIS transportation analyses might not be the routes used for actual shipments. The route selection process would be conducted in accordance with applicable U.S. Department of Transportation regulations on route selection, state or tribal routing designations allowable under existing regulations, and the processes described in Section M.3.2.1.2 of the EIS. Section J.4 identifies the representative truck and rail routes DOE used in the impact analyses.

8.10.2 (194)
Comment - 8 comments summarized
Commenters expressed concern about the welfare of workers such as police and fire department personnel and first responders in the event of an emergency and stated that the Draft EIS inadequately assessed the potential increased exposure of and health risks to emergency first responders. Other commenters stated that the Draft EIS did not consider the impacts of accidents on hospital workers and health care professionals who might be in direct contact with high-level radioactive waste via the injured and at the scene. Another commenter was particularly concerned about rural areas where local emergency workers and health care professionals without specialized training might be the first and only workers on an accident scene for many hours. Commenters questioned what provisions would be provided for the families of workers and first responders since there would be a loss of income while injured victims recuperated. Other commenters asked how first responders to potential accidents would be notified of potential life threatening exposures. Others stated that millions of Americans could be put at risk in addition to emergency responders. Some commenters asked whether DOE would provide the necessary planning mechanism, Material Safety Data Sheets, and levels of personal protection equipment to the local emergency planning committees to distribute to first responders.

Response
In response to public comments, DOE has modified Section 6.2.4.2.1 of the EIS to include estimated radiological impacts to emergency personnel who would respond to transportation accidents. The analysis assumed a first responder would be trained and would follow guidance in the *2000 Emergency Response Guidebook* (DIRS 155776-DOT 2000) when responding to transportation accidents involving shipments of radioactive materials. The maximum estimated dose to a first responder would be 830 millirem. This dose, which is about 40 percent of the limit for annual dose to radiation workers at DOE facilities, would lead to an increase of about 0.03 percent in the individual's lifetime risk of a latent fatal cancer. Health care professionals would likely receive smaller doses from caring for radioactively contaminated accident victims or workers.

In addition, DOE has added information to the EIS on the proposed operational aspects of spent nuclear fuel and high-level radioactive waste transportation, emergency response planning, and financial assistance programs. (See Sections M.3 through M.6.) Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. The training would cover procedures required for safe routine transportation of these materials, as well as procedures for addressing emergency response situations. DOE would provide the assistance based on the training needs of the states and tribes, as they determined using a planning grant and based on availability of funds in annual Program

budgets specified by Congress. Additional Federal response capabilities, such as expert services from the Radiological Assistance Program Team, could be activated, as requested by states and tribes. The schedule in the proposed policy and procedures (63 *FR* 23753, April 30, 1998) for implementation of Section 180(c) of the NWPA is designed to provide adequate time for training of first responders in advance of the first shipments. If there was a decision to proceed with the development of a repository at Yucca Mountain, shipping routes would be identified at least 4 years before shipments began and Section 180(c) assistance would be made available approximately 4 years prior to shipments through a jurisdiction. See Section M.6 for a discussion of the DOE Section 180(c) policy and procedures.

DOE has several programs available to provide assistance to state, tribal, and local governments in response to radioactive material accidents. The Radiological Assistance Program, for example, provides trained personnel with equipment to evaluate, assess, advise, and assist in the mitigation and monitoring of potential immediate hazards associated with a transportation accident. As part of the program, DOE maintains eight Regional Coordinating Offices across the country that are staffed 24 hours a day, 365 days a year. The staff consists of nuclear engineers, health physicists, industrial hygienists, public affairs specialists, and other personnel who provide field monitoring, sampling, decontamination, communications, and other services, as requested. In addition, DOE's Radiation Emergency Assistance Center/Training Site (REAC/TS) focuses on providing rapid medical attention to people involved in radiation accidents. REAC/TS maintains a 24-hour response center to provide direct support, including deployable equipment and personnel trained and experienced in the treatment of radiation exposure to assist Federal, state, tribal, and local organizations.

DOE would provide information concerning shipments to the state-designated point of contact for advance notification of the shipments. If approved by the Nuclear Regulatory Commission, states and tribes could monitor the shipments by a satellite tracking and communications system. Drivers of trucks and crews of trains transporting radioactive material would carry shipping papers, as required by U.S. Department of Transportation regulations. These papers would identify the cargo as required by regulations in 49 CFR Part 172, Subpart C. In addition, placards that identify the cargo as radioactive would be prominently displayed on transport vehicles, as required by Department of Transportation regulations.

With respect to compensation for losses associated with an accident involving spent nuclear fuel and high-level radioactive waste, the Price-Anderson Act (discussed in Section M.8 of the EIS) establishes a system of financial protection for persons liable for and for persons injured by a nuclear accident or incident. The Price-Anderson Act establishes a system of private insurance and Federal indemnification that generally ensures that up to $9.43 billion is available to compensate for damages suffered by the public, regardless of who causes the damages. Beyond that level, Congress will consider further action it determines is necessary to provide full and prompt compensation to the public. The Price-Anderson Act indemnifies all persons liable for the nuclear damage including state, local, and tribal governments, emergency response workers, health care personnel, victims, and any other citizens or members of the public.

8.10.2 (200)
Comment - 20 comments summarized
Commenters stated that no baseline emergency response capability was established along the potentially affected routes or in affected communities. Because no baseline was established in the affected communities, the impact on community emergency preparedness could not be determined; therefore, the Draft EIS failed to meet National Environmental Policy Act requirements. They stated that a credible evaluation would identify the adequacy or inadequacy of emergency response capacity along routes and allow the state and local authorities to deploy the necessary resources. Commenters stated that emergency response capabilities must be described as part of the affected environment and that emergency services are an essential part of local public services. Other commenters questioned whether the emergency medical facilities, fire departments, and police departments in an affected community would be adequately equipped and trained to handle an emergency situation. Commenters stated that the EIS should identify what emergency response, equipment, facilities (for example, isolation rooms for radioactively contaminated individuals), and trained personnel are available in these communities. One commenter stated that radioactive materials can be shipped safely with no significant risk to any population, including emergency responders, if basic measures are taken, such as identifying the emergency response agency having jurisdiction over a specific route, providing that agency with a copy of the training materials, and providing each agency the opportunity to have personnel attend an instructor-led class.

Response
In evaluating the potential impacts of transportation accidents in the EIS, DOE conservatively assumed that no emergency response would occur and evaluated the full impacts of the accident on the surrounding population. The analysis of impacts of transportation accidents in the EIS (Section J.1.4.2.1) does not take credit for emergency response efforts to reduce exposures to individuals. Therefore, the impacts consider the range of what could happen regardless of the emergency response capabilities of jurisdictions along transportation routes. If responders followed standard emergency response procedures, such as avoiding the downwind smoke of a major fire, exposures would be low. However, because DOE could not predict what type of emergency response would be available, it could not factor any mitigation of impacts as a result of such measures into the EIS analysis.

Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions the Department would transport spent nuclear fuel and high-level radioactive waste. The training would cover procedures required for safe routine transportation of these materials, as well as procedures for addressing emergency response situations. DOE would provide the assistance based on the training needs of the states and tribes, as they determined using a planning grant and based on availability of funds in annual Program budgets specified by Congress. Additional Federal response capabilities, such as expert services from the Radiological Assistance Program Team, could be activated, as requested by states and tribes. See Section M.6 of the EIS for a discussion of the DOE Section 180(c) policy and procedures.

If there was a decision to proceed with the development of a repository at Yucca Mountain, shipping routes would be identified at least 4 years before shipments began and Section 180(c) assistance would be made available approximately 4 years prior to shipments through a jurisdiction. At present, DOE intends to purchase services and equipment from Regional Servicing Contractors who would perform waste acceptance and transportation operations. The Department has issued a draft Request for Proposals requiring each Regional Servicing Contractor to prepare a transportation plan that describes the contractor's operational strategy and delineates the steps it would implement to ensure compliance with all regulatory and other DOE requirements. This includes identification of proposed routes and associated routing considerations, coordination and communication with all participating organizations and agencies, including other Regional Servicing Contractors, DOE, state, tribal, and local governments, and interactions with appropriate Federal and state organizations. The route and mode determinations would be interactive. If, during the course of the mode or route determinations, one of the previously determined factors changed, the site-specific mode and route analysis would be reevaluated to ensure consistency. The Regional Servicing Contractor would consult with other Regional Servicing Contractors as appropriate to ensure continuity and consistency of routes and to ensure trained emergency response personnel capability.

After identifying a specific route, the Regional Servicing Contractor would submit the route plan to DOE for approval prior to its submittal to the Nuclear Regulatory Commission in accordance with 10 CFR 73.37 [a][7]. Additional mode and route selection factors are in a U.S. Department of Transportation report, *Identification of Factors for Selecting Modes and Routes for Shipping High-Level Radioactive Waste and Spent Nuclear Fuel* (DIRS 103718-DOT 1998).

For highway shipments, the Regional Servicing Contractor's transport carriers would use "preferred" routes as specified in 49 CFR 397.101[b][1]. Section M.3 of the EIS contains more information about the proposed role of the Regional Servicing Contractor.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site was recommended and approved. See the introduction to Chapter 8 of this Comment-Response Document for more information.

8.10.2 (203)
Comment - 21 comments summarized
Issues Commenters expressed concern about communities or counties in either rural or remote areas located along transportation routes because the necessary equipment, trained personnel, or funding would not be available to respond to an accident involving spent nuclear fuel and high-level radioactive waste. Other commenters noted that

the distance to the nearest hospital could be as much as 145 kilometers (90 miles) in some communities and that because of this the response time could exceed 90 minutes. Another commenter stated that transporting spent nuclear fuel and high-level radioactive waste through rural areas with limited emergency response capabilities would increase the risk associated with transportation incidents and asserted that the risk would be higher because of the lack of response capability and the time delay for personnel to respond. Commenters noted that the closest hospital might not be equipped to handle an emergency involving a nuclear accident. Commenters stated that the Draft EIS assumed that the risk of transporting spent nuclear fuel and high-level radioactive waste through rural areas in Nevada would be no greater than through urban communities. However, the commenter stated that assumption was incorrect because first responders and emergency medical service providers in rural areas would be largely unprepared to handle radiation emergencies. Commenters stated that rural communities would be helpless, at least immediately, in the event of a serious accident.

Response

In response to public comments, DOE has added information (see Appendix M of the EIS) on the proposed operational aspects of spent nuclear fuel and high-level radioactive waste transportation, the safety of transportation casks, emergency response planning, and financial assistance programs (see Section M.5). In addition, based on the revised analyses DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 presents consequences for accidents that could release radioactive materials.

In evaluating the potential impacts of transportation accidents in the EIS, DOE conservatively assumed that no emergency response would occur and evaluated the full impacts of the accident on the environment and the surrounding population. The analysis of impacts of transportation accidents in the EIS (Section J.1.4.2.1) does not take credit for emergency response efforts to reduce exposures to individuals. Therefore, the impact assessment considered the range of what could happen regardless of the emergency response capabilities of jurisdictions along transportation routes. If responders followed standard emergency response procedures, such as avoiding the downwind smoke of a major fire, estimated exposures would be reduced. Standard emergency response actions could reduce or prevent radiological exposures. The transportation analyses do take into account the differing transportation accident rates in rural and urban areas in calculating accident probabilities.

Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. The training would cover procedures required for safe routine transportation of these materials, as well as procedures for addressing emergency response situations. DOE would provide the assistance based on the training needs of the states and tribes, as they determined using a planning grant and based on availability of funds in annual Program budgets specified by Congress. Additional Federal response capabilities, such as expert services from the Radiological Assistance Program Team, could be activated, as requested by states and tribes. The schedule in the proposed policy and procedures for implementation of Section 180(c) of the NWPA (63 *FR* 23753, April 30, 1998) is designed to provide adequate time for training of first responders in advance of the first shipments. If there was a decision to proceed with the development of a repository at Yucca Mountain shipping routes would be identified at least 4 years before shipments began and Section 180(c) assistance would be made available approximately 4 years prior to shipments through a jurisdiction. See Section M.6 of the EIS for a discussion of the DOE Section 180(c) policy and procedures.

If there was an accident involving a shipment of spent nuclear fuel or high-level radioactive waste, the first responders and response time would be the same as for any transportation accident. If a release occurred, and local officials were not prepared to deal with it, immediate assistance could be obtained from the DOE Radiation Emergency Assistance Center/Training Site. Appendix M of the EIS contains additional information that addresses these issues.

8.10.2 (212)
Comment - 49 comments summarized
Commenters stated that their communities would be totally unprepared for the consequences of an accident, sabotage, or terrorism and stated that all Native American tribal, state, and local jurisdictions must be fully prepared for spent nuclear fuel and high-level radioactive waste shipments and should be involved in the development of emergency preparedness plans. Others stated that acceptable emergency response plans should be developed and implemented before the initiation of shipments. Other commenters noted that transportation companies and railways would require emergency plans before any shipment could occur. Commenters wanted to know where radioactively contaminated victims would be taken and noted that many hospitals do not have isolation rooms for this type of situation. Others asked how many hospitals in this country would have the capability of handling such an emergency. Other commenters stated that the Draft EIS did not adequately evaluate the potential demands on affected local government related to public health and safety with respect to activities that could occur, such as identifying evacuation routes within city limits.

Commenters stated that the Draft EIS was inadequate because there was neither analysis of potential activities and cost during all phases of emergency management, nor were data given regarding the development of emergency action plans for any metropolitan area affected by potential transportation of spent nuclear fuel and high-level radioactive waste to the proposed repository. One commenter stated that the Draft EIS did not specifically address emergency preparedness along rail spurs, heavy-haul and legal-weight truck routes, or at prospective intermodal transfer stations. Another commenter stated that the Draft EIS must describe specific responsibilities for providing, managing, and maintaining emergency response capabilities, including identifying responsibility for emergency management and response training, responsibility for mitigating accidents, and responsibility for administering funds for emergency response assistance. One commenter stated that the state agencies that would be responsible for overseeing shipments of radioactive spent nuclear fuel and high-level radioactive waste through their communities would ensure that the appropriate shipping standards would be met. Another commenter stated that DOE should seek to enter into a memorandum of understanding with each corridor state to spell out responsibilities, liability, compensation, response times, cleanup, and other duties connected with emergency situations.

Response
As discussed in Section 6.2.4.2 of the EIS, accidents involving the transportation of spent nuclear fuel or high-level radioactive waste shipments could occur. However, of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. As a consequence, the likelihood that a first responder or other emergency personnel would become contaminated, even in very severe accidents, would be remote. The only expected radiological exposure of first responders would be from gamma radiation and neutrons penetrating the shielding of the casks. These radiation levels would be are low, easily measured, and controlled to meet the limits of Nuclear Regulatory Commission regulations. Additional information on cask safety and testing is provided in Section M.4 of the EIS. Additional information on emergency response following an accident is provided in Section M.5.

Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. The training would cover procedures required for safe routine transportation of these materials, as well as procedures for addressing emergency response situations. DOE would provide the assistance based on the training needs of the states and tribes, as they determined using a planning grant and based on availability of funds in annual Program budgets specified by Congress. Additional Federal response capabilities, such as expert services from the Radiological Assistance Program Team, could be activated, as requested by states and tribes. The schedule in the proposed policy and procedures for implementation of Section 180(c) of the NWPA (63 *FR* 23753, April 30, 1998) is designed to provide adequate time for training of first responders in advance of the first shipments. If there was a decision to proceed with the development of a repository at Yucca Mountain, shipping routes would be identified at least 4 years before shipments began and Section 180(c) assistance would be made available approximately 4 years prior to shipments through a jurisdiction. Additional information on Section 180(c) is provided in Section M.6 of the EIS.

Although DOE and its contractors would develop their own emergency response plans, the preparation and implementation of emergency response and evacuation and contingency plans are a state or tribal responsibility for

lands within their jurisdictions. Section 180(c) funding would be provided to eligible jurisdictions for the preparation of these plans, as well as emergency response and safe routine transportation planning and coordination activities.

In the unlikely event someone was contaminated as the result of an accident involving shipments to a repository, there are several means to deal with such incidents. Major hospitals are equipped to deal with radioactive contamination because they routinely handle medical radioisotopes. In cases where there is no training or procedures to handle a contaminated individual, assistance can be obtained from the DOE Radiation Emergency Assistance Center/Training Site (REAC/TS). REAC/TS is on call 24 hours a day to provide direct or consultative help when people have been involved in a radiation accident.

As with any transportation accident, state and tribal governments have primary responsibility to respond and to protect the public health and safety in their jurisdictions in accidents involving radioactive materials. This includes providing and managing emergency response capabilities. Although DOE would provide the funding for Section 180(c) activities, each state and tribe would determine how it would administer that funding.

At present, DOE intends to purchase services and equipment from Regional Servicing Contractors, who would perform waste acceptance and transportation operations. Each Regional Servicing Contractor would be required to provide detailed written procedures for how it would respond to an incident and arrange for repair/replacement of equipment or recovery, as appropriate. In accordance with ANSI Standard N14-27 (DIRS 156289-ANSI 1987), the carrier is expected to provide appropriate resources for addressing the consequences of an accident, isolating and cleaning up contamination, and maintaining working contact with the responsible governmental authority until the latter has declared the incident to be satisfactorily resolved and closed. Section M.3 of the EIS contains more detail on the proposed role of the Regional Servicing Contractors.

Existing Federal and state regulations and DOE documents delineate responsibility for duties connected with emergency situations. Section M.5 of the EIS contains additional information on emergency response.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site was recommended and approved. See the introduction to Chapter 8 of this Comment-Response Document for more information.

8.10.2 (218)

Comment - 7 comments summarized

Commenters expressed specific concerns regarding what equipment would be available to first responders for use in the event of an incident. One commenter asked if state highway patrolmen carried monitoring devices for performing radiation checks in the event of an accident, because a radiation survey would need to be performed immediately. Others stated that emergency responders should be provided with appropriate equipment such as suitable detection devices, heavy shielding for construction equipment, adequately shielded ambulances and instrumentation to permit monitoring in the event of an accident. Others stated that DOE should provide corridor jurisdictions with in-vehicle radio repeaters, binoculars, cellular telephones and other equipment. Another commenter stated that each jurisdiction along affected transportation routes should be provided with two new detection instruments and ongoing calibration services in conjunction with training. Other commenters recommended that the Federal Government encourage the development of and help fund sophisticated state emergency management communication centers in transportation corridors to enhance emergency preparedness and response along potential routes. Commenters stated that DOE should distribute to local public safety and emergency response agencies surplus equipment for use in the event of an emergency.

Response

In response to public comments, in Section 6.2.4.2.1 of the EIS, DOE provides estimates of radiological impacts to emergency personnel who would respond to transportation accidents in which the severity and consequences would be the maximum reasonably foreseeable. In developing the estimates, DOE assumed a first responder would be trained and would follow guidance contained in the U.S. Department of Transportation's *2000 Emergency Response Guidebook* (DIRS 155776-DOT 2000). For example, on arriving at the scene of an accident, a trained responder

determines the presence and identification of hazardous materials that might be involved, cordons off the area to protect members of the public, rescues injured persons, initiates protective actions such as moving upwind and at a distance from the accident scene, and calls for assistance. DOE estimated the maximum dose to a first responder to a rail accident would be 830 millirem from external radiation. The analyzed accident would be one in which forces or heat would be great enough to cause a loss of a portion of a cask's lead shield. The resulting dose to the first responder, which would be about 40 percent of the limit for annual dose to radiation workers at DOE facilities, would lead to an increase of about 0.03 percent in the individual's lifetime risk of a latent fatal cancer. First responders to very severe accidents involving truck shipments would receive much lower doses.

Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. In 1998, DOE published a Notice of Revised Proposed Policy and Procedures in the *Federal Register* (63 *FR* 23753; April 30, 1998) that sets forth the proposed mechanisms for implementing the requirements of Section 180(c). As part of this program, about 4 years prior to the first shipments eligible jurisdictions would receive a one-time planning grant to assess their training needs. In accordance with the Draft Section 180(c) Policy and Procedures, jurisdictions may use a certain percentage of their financial assistance to purchase appropriate (for example, training-related) equipment that can be used for training, inspections, and for emergency response. This could include the detection equipment mentioned in the comment. See Section M.6 of the EIS for a detailed discussion of the Section 180(c) provisions and emergency response programs. If requested, DOE and other Federal agencies could assist in responding to an incident.

DOE has several programs available to provide assistance to state, tribal, and local governments in response to radioactive material accidents. The Radiological Assistance Program, for example, provides trained personnel with equipment to evaluate, assess, advise, and assist in the mitigation and monitoring of potential immediate hazards associated with a transportation accident. As part of the program, DOE maintains eight Regional Coordinating Offices across the country that are staffed 24 hours a day, 365 days a year. The staff consists of nuclear engineers, health physicists, industrial hygienists, public affairs specialists, and other personnel who provide field monitoring, sampling, decontamination, communications, and other services, as requested. In addition, DOE's Radiation Emergency Assistance Center/Training Site (REAC/TS) focused on providing rapid medical attention to people involved in radiation accidents. REAC/TS maintains a 24-hour response center to provide direct support, including deployable equipment and personnel trained and experienced in the treatment of radiation exposure to assist Federal, state, tribal, and local organizations.

With regard to communications, DOE intends to use a satellite tracking system to monitor shipments to Yucca Mountain. If approved by the Nuclear Regulatory Commission under regulations contained in 10 CFR Part 73, DOE would provide training on, and equipment for, states and tribes to track and communicate about shipments under the NWPA. Additional information on satellite tracking of shipments is in Section M.3.2.1.5 of the EIS.

8.10.2 (579)
Comment - EIS000066 / 0003
In the event of an accident which results in the release of spent nuclear fuel and radioactive waste, an extensive water sampling program would be required to ensure that there are no adverse health effects. This sampling, coupled with spill control and contamination prevention measures, could result in the closing of water and wastewater treatment plants which would, thereby, create water shortages and sanitation problems. Consideration should be given to plans for providing emergency supplies of potable water and emergency wastewater treatment.

Using a list of all populated areas through which a Kentucky route passes, an emergency notification guide needs to be prepared. The guide needs to list for each populated segment a 24-hour telephone number for the local water and wastewater authorities. The drivers of the highway vehicles or the crews of the trains with the railroad cars containing the spent nuclear fuel and radioactive waste need to have instructions to notify those local authorities so that appropriate action could be taken to protect:

- the intakes and facilities of water treatment plants,
- wastewater treatment plants by having the spilled material held in interceptors or routed to bypass the plant, and
- the operators of water and wastewater plants.

Transporters need to comply with the federal Hazardous Materials Transportation Safety Act (49 U.S.C. Section 1801 *et seq.*) requirements including contingencies for response contractors, phone notifications, and special requirements for monitoring Cleaning.

Response
It is extremely unlikely an accident involving shipments of spent nuclear fuel or high-level radioactive waste would result in the release of spent nuclear fuel or radioactive waste. The Nuclear Regulatory Commission regulates the design, construction, use, and maintenance of shipping containers or casks for shipments of spent nuclear and high-level radioactive waste. The casks must be designed to withstand a series of impact, puncture, and fire environments, thereby providing reasonable assurance that packages would withstand serious transportation accidents. See Section M.4 of the EIS for additional information on cask safety and testing.

States and tribes through whose jurisdictions shipments would be made would receive prior notification of the shipments in accordance with Nuclear Regulatory Commission requirements. The notification process is discussed in Section M.3.2.2.1 of the EIS. The contractor providing transportation services to DOE would be required to have an Emergency Response Plan that provided for appropriate notifications to Federal agencies and state, tribal, and local units of government in the event of an emergency. Continuous real-time tracking of all shipments to the repository would provide the location of any incident. However, if an accident with release of radioactive waste was to occur, the state or tribe could request assistance from Federal agencies. DOE, the Environmental Protection Agency, and the Department of Agriculture would monitor water and wastewater to determine contamination and appropriate treatment in accordance with the Federal Radiological Emergency Response Plan. These agencies, as well as the Federal Emergency Management Agency and the Department of Health and Human Services, would help to ensure the distribution of potable water supplies if needed. Section M.6 describes the assistance available in greater detail.

Transporters would be in compliance with the U.S. Department of Transportation's Hazardous Materials Transportation Safety regulations. These regulations implement the provisions of the Hazardous Materials Transportation Safety Act.

8.10.2 (680)
Comment - EIS000205 / 0005
Roughly 50,000 truck shipments will ultimately travel through 43 states past millions of people over the lifetime of the project. Accidents will happen, and we cannot be sure that communities will be prepared to respond when they do. The DEIS does not sufficiently discuss the proposed shipping routes or the training and equipment necessary for emergency response personnel in communities along the route. This information is an essential part of determining the safety of the shipments.

Response
As discussed in Section J.1.2.2 of the EIS, DOE has not yet determined the specific modes or routes it would use to ship spent nuclear fuel and high-level radioactive waste to the proposed repository. During the long period before shipments could begin, many factors affecting route designation could change. However, DOE used current U.S. Department of Transportation regulations governing highway shipments (49 CFR 397.101) and historic rail industry practices to select existing highway and rail routes for the analyses presented in the EIS. Additional information on procedures and protocols on how routes would be eventually selected is provided in Section M.3.2.1.2. Section J.4 presents state maps showing the routes used in the analysis.

The training and equipment required for emergency response for shipments of spent nuclear fuel and high-level radioactive waste would be determined by the state, tribal, and local governments through whose jurisdictions shipments would pass. DOE has proposed a one-time only planning grant to every eligible state and tribe to aid in this determination. A discussion of funding and technical assistance for the training and associated equipment necessary for emergency response personnel in communities along shipping routes is provided in DOE's Draft Proposed Policy and Procedures for implementing the requirements of Section 180(c) of the NWPA [see Section M.6 of the EIS for additional information on emergency response responsibilities and capabilities and Section M.6 for additional information on implementation of Section 180(c)].

8.10.2 (999)
Comment - EIS000235 / 0006
The Draft EIS is silent on the need for local emergency medical capabilities. The extent to which Section 180(c) and other DOE-funded enhancements to local emergency response capabilities might reduce risk below even existing levels should be addressed within the Final EIS.

Response
As discussed in Section J.1.4.2 of the EIS, in an effort to consider the associated range of potential impacts from accidents, the analyses in the EIS did not take credit for or assume emergency response interdiction, dose mitigation, or evacuation to reduce accident consequences. Nonetheless, impacts of accidents are estimated to be small for transporting spent nuclear fuel and high-level radioactive waste either using legal-weight trucks or rail transportation. Thus, although it could be possible to reduce consequences of the most severe accidents, reductions in risk that could be achieved through enhancements in local emergency response capabilities would be small.

Under Section 180(c) of the NWPA, eligible states and tribes will be provided funds to determine their emergency response capabilities and training needs. Section M.5 of the EIS provides additional information on the implementation of Section 180(c).

8.10.2 (1325)
Comment - EIS000991 / 0003
The IAFC [International Association of Fire Chiefs] is primarily concerned with the safety of the actual transport of the nuclear waste materials. In the event of a transportation accident, a local fire department will most often be the first responder. Thus our interest in the rules and regulations governing the transportation of nuclear waste materials. Prior to any shipment we believe the following rules, regulations, and protocols must be in place:

- Require cask designs able to withstand severe accident scenarios with substantial built-in safety factors. A safe container will assure that no material will leak from a cask involved in a large catastrophic accident. This will protect the responders, citizens, and the environment from danger and contamination.

- Require proper marking, labeling, placarding, shipping papers and emergency response information as regulated by U.S. Department of Transportation for rail and highway shipments be in place.

- Require the filing of written route plans to include origin/destination of the shipment, routes, planned stops, estimated arrival, and emergency telephone numbers in each state through which the shipment will traverse.

- Require carriers to use preferred routes for highway shipments - interstate highways, bypasses and beltways. States may propose alternate routes to the interstate highway system. However, fire and emergency response agencies in the potentially affected states and localities must be consulted in designation of alternate routes.

- Require that shippers notify the governor seven days in advance of the material being transported through the state.

- Recommend that legislation and regulation require governors and their emergency managers to notify the response forces in each jurisdiction through which shipment will pass. It is critical for local planning purposes that this notification be made.

- Require a tail escort for each shipment. This escort needs to be knowledgeable of radiation, have appropriate equipment and instruments, be uniformed, be knowledgeable of the Incident Command System and be ready to provide intelligence information to the Incident Commander about the condition associated with the radioactive materials involved. After shipments become a routine matter, consideration may be given eliminating the escort.

Response
DOE agrees with the International Association of Fire Chiefs that a primary concern is the safety of the transport of spent nuclear fuel and high-level radioactive waste. Most of the recommendations in the comment are incorporated

in the regulations that DOE and its contractors would observe strictly, and are reflected in the transportation protocols included in the discussion of processes and protocols included in the draft Request for Proposals, *Acquisition of Waste Acceptance and Transportation Services for the Office of Civilian Radioactive Waste Management* (DIRS 153487-DOE 1998), summarized in Section M.3.1 of the EIS. A response to each recommendation follows.

Casks would be designed to meet Nuclear Regulatory Commission regulations in 10 CFR Part 71. Studies have shown that casks would survive severe real-world accidents.

All U.S. Department of Transportation regulations for marking, labeling, placarding, shipping papers, and emergency response information would be rigorously followed.

Route plans would be prepared as required by the Nuclear Regulatory Commission regulations in 10 CFR 73.37. In addition to the information recommended by the commenter, the route plans would include the location of safe havens.

Carriers would use preferred routes for highway shipments, as required by Federal regulations at 49 CFR Part 397, Subpart D.

The governor or the governor's designee would be notified as required by Nuclear Regulatory Commission regulations at 10 CFR 73.37(f). Notification of local response forces would be provided in accordance with individual state procedures. However, 10 CFR 73.37(g) requires any individual, whether or not a licensee of the Commission, to protect schedule information against unauthorized disclosure as specified in 10 CFR 73.21. In addition, the regulations require the shipper to provide that arrangements have been made with local law enforcement agencies along the routes of road and rail shipments, and at U.S. ports where vessels carrying spent nuclear fuel shipments are docked, for their response to an emergency or a call for assistance.

Training requirements for shipment escorts are specified in Appendix D of 10 CFR Part 73.

8.10.2 (1745)
Comment - EIS000366 / 0001
I want to talk about emergency response to mobile Chernobyl, if you would. When and where there is a transportation accident – it's a foregone conclusion by the general public -- some questions arise. (1) What agency will provide the first response -- federal, state, or local agency? (2) What training will have been provided to the responders and by whom? (3) Who will bear the overall financial responsibility for such training and equipment necessary for local containment? And, lastly, who will bear the costs beyond the emergency response, such as regional effects like the river contamination that happened at Dunsmuir on the Sacramento River and contaminated Shasta Lake a few years back?

Response
As discussed in Section M.5.1 of the EIS, states and Native American tribes are primarily responsible for the health and safety of their citizens. Although the transporting personnel would be at the scene, state, local, or tribal emergency response personnel would be the first public safety officials to respond to hazardous materials accidents and would assume incident management on arrival (Section M.5.2 contains more information). The state, local, or tribal government could request assistance from Federal agencies under the Federal Radiological Emergency Response Plan. Section M.6 contains more information on available assistance.

Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for determining the need for and training of public safety officials of appropriate units of local government and tribes through whose jurisdictions it would ship spent nuclear fuel and high-level radioactive waste. This training would cover procedures for dealing with incident-free transportation and emergency response situations. It would be up to state, local, and tribal authorities to determine who would receive training and what equipment would be required. DOE would provide funds for training and the associated purchase of equipment for safe routine transportation and emergency response. Costs beyond emergency response would be borne by the transportation contractor's insurance and by coverage under the Price-Anderson Act. The Price-Anderson Act provides for indemnification of liability up to $9.43 billion to cover claims that might arise from an accident in which radioactive materials were released or one in

which an authorized precautionary evacuation was made (see Section M.8 of the EIS for a more complete discussion of the Price-Anderson Act).

8.10.2 (2273)
Comment - EIS000669 / 0002
The residents of Lincoln County and the City of Caliente are already facing risks of hazardous and radiological materials.

Daily, several hundred box cars and tankers pass through Caliente on rail with chlorine, propane, and other pressurized toxic chemicals which, if the tanker is ruptured, escape into the environment, especially chlorine would be virtually instantaneously fatal for virtually the whole valley here.

Approximately 1,000 box cars of explosives annually travel through this community. Thousands of tankers of toxic non-pressurized chemicals go through here in 10,000 gallon units in the tankers. Currently we have scheduled shipments of low-level radiological waste passing through this community, and the frequency which will accelerate as the bad weather closes off the northern routes and they have to further drive down the highways in the southern routes. This is one of the areas that they drive through to get to the NTS [Nevada Test Site].

Current levels of capabilities of handling chemicals or radiological contaminations -- let's pretend that one of us was chemically contaminated with a fuel or some other chemicals.

They take us out to the gutter outside the hospital, strip us down as far as necessary, and that may include everything. Wash us off with a garden hose until the chemical contamination was released and then they'd be able to put us on a gurney and take us into the facility since we'd be simply a patient.

As far as I'm concerned, that's unacceptable.

Response
The potential for accidents involving transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mountain is discussed in Chapter 6 and Appendix J of the EIS. The potential for a release of radioactive material and contamination of individuals is very small and is not expected to occur during the 24-year period of transportation. Of the thousands of shipments completed over the last 30 years, none has resulted in an identifiable injury through release of radioactive material. The Nuclear Regulatory Commission regulates the design, construction, use and maintenance of shipping containers or casks for shipments of spent nuclear fuel and high-level radioactive waste. The casks must be designed to withstand a series of impact, puncture, and fire environments, thereby providing reasonable assurance that packages would withstand serious transportation accidents. Additional information on cask safety and testing is provided in Section M.4.1.

In addition, emergency responders would be prepared in the event of an accident. Section 180(c) of the NWPA requires DOE to provide financial and technical assistance to states and tribes to train emergency responders. DOE is committed to providing funding to the State of Nevada – which would in turn provide funding to potentially affected cities and counties - for emergency planning and emergency response training in event of accidents involving Yucca Mountain-bound material. If additional resources were required to handle an accident, the state or tribe could call upon Federal agencies for assistance. For example, in providing treatment to a person who might have become contaminated, assistance could be requested from the DOE Radiation Emergency Assistance Center/ Training Site (REAC/TS). REAC/TS is on call 24 hours a day to provide direct or consultative help with cases where people have been involved in a radiation accident. Additional information of emergency responsibilities and capabilities is provided in Section M.5.1 of the EIS. Section M.6 provides additional information on the provisions of Section 180(c).

8.10.2 (2350)
Comment - EIS000707 / 0001
What provisions have been made to equip the medical community, not only in Nevada, but the other 43 states along the transportation route, to handle a radioactive hazard waste accident?

- Will the DOE train the appropriate medical staff to respond to such an emergency?
- Who will incur the cost of such training?
- Who will be responsible for the cost of medical treatment of any victims?
- How will these people who are exposed to nuclear waste be compensated for time lost from work?
- In the event of a terminal illness, as a result of the nuclear accident, who would be responsible for [retribution] to the families?

Response
Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training public safety officials of units of local government and Native American tribes through whose jurisdictions spent nuclear fuel or high-level radioactive waste would be transported on its way to a repository. This technical assistance and training covers procedures required for safe routine transportation of these materials, as well as for dealing with emergency response situations. The training could apply to state, local, or tribal emergency personnel including medical emergency responders.

States and tribes are primarily responsible for the health and safety of their citizens. However, in the event of an accident that released radioactive materials, a jurisdiction could request assistance from Federal agencies under the Federal Radiological Emergency Response Plan and Federal Radiological Monitoring and Assessment Plan. DOE has several assets that could assist, including the Radiation Emergency Assistance Center/Training Site (REAC/TS). REAC/TS is on call 24 hours a day to provide direct or consultative help with cases where people have been involved in a radiation accident.

With regard to who would pay for costs such as medical treatment, compensation for time lost from work, and compensation to families for terminal illnesses resulting from an accident, the U.S. Department of Transportation requires transporters of hazardous materials to carry insurance covering accidents. Costs associated with accidents would be borne by the transportation contractor's insurance and by coverage under the Price-Anderson Act. The Price-Anderson Act provides for indemnification of liability up to $9.43 billion to cover claims that might arise from an accident in which radioactive materials were released or one in which an authorized precautionary evacuation was made (see Section M.8 of the EIS for a more complete discussion of the Price-Anderson Act).

8.10.2 (2740)
Comment - EIS000641 / 0004
The next thing in health and safety, I guess it's been rehashed, but I would like to say it anyway, monitoring. Whose responsibility is it to monitor these things? The air quality, the ground quality, the water quality, this sort of thing. Who is to participate in this? Is it to be the federal government, the regulatory agencies, county, and where does the money come from?

You don't believe the county is tight, ask Pete. And he won't spend any money, I guarantee that.

Response
As discussed in Section M.5.1 of the EIS, states and tribes are primarily responsible for the health and safety of their citizens. However, Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for determining the need for and training of public safety officials of appropriate units of local government and tribes through whose jurisdictions it would ship spent nuclear fuel and high-level radioactive waste. This training would cover procedures for dealing with incident-free transportation and emergency response situations. It would be up to state, local, and tribal authorities to determine who would receive training and what equipment would be required. DOE would provide funds for training and the associated purchase of equipment for safe routine transportation and emergency response.

In addition, several Federal agencies have training and available capabilities should states or tribes request them. If an accident with release of radioactive waste occurred, affected states and tribes could request assistance from DOE, Environmental Protection Agency, Department of Agriculture, Department of Health and Human Services, and the

Federal Emergency Management Agency. These agencies, in cooperation with states, tribes, and each other, would monitor and assess radioactive materials in air, ground, agricultural products, and water in accordance with the Federal Radiological Emergency Response Plan and the Federal Radiological Monitoring and Assessment Plan. The costs for such services would be borne by the Federal agencies.

Costs associated with accidents would be borne by the transportation contractor's insurance and by coverage under the Price-Anderson Act. The Price-Anderson Act provides for indemnification of liability up to $9.43 billion to cover claims that might arise from an accident in which radioactive materials were released or one in which an authorized precautionary evacuation was made (see Section M.8 of the EIS for a more complete discussion of the Price-Anderson Act).

Section M.3.2 of the EIS describes the operating protocols, including monitoring of the conduct of transportation activities, that DOE's Regional Servicing Contractors would carry out. In addition, states could require and perform monitoring of transportation activities as a part of their permitting process.

8.10.2 (3213)
Comment - EIS001120 / 0003
Currently our local area, as well as other rural regions, is grossly understaffed, under budgeted, and unprepared to respond to current accidents involving the release of hazardous waste. DOE promises to provide local entities with assistance to prepare for the eventuality of a nuclear waste release occurring from an incident involving one of the 49,000 truck shipments and/or 13,000 rail shipments.

A minimum of 1/3 of our state is covered by mountains where distances between towns is not measured by miles, but by how many hours it takes to get from one place to another. With waste being transported from 72 commercial sites and five DOE facilities, how could DOE respond (or any other regional response team) in an adequate time given the restraints of geography, the enormous size of region the waste is being transported across and the sheer volume of waste being shipped over the next two decades?

Each community cannot afford its own emergency response team to prepare for the possibility of a nuclear clean up. The time that lapses between notification and response could mean the difference between total and partial ruination of a local habitat, area, region or watershed. What possible solution could DOE design to eliminate concerns of response time? Transportation of this waste is an endangerment to all living things.

Many of our major highways run parallel to our major drainages and waterways. Containment of this type of waste would be impossible once it has reached one of those watersheds. The Colorado River serves as basin providing water to a minimum of five states and Mexico. No amount or duration of response and resulting attempts to clean up a spill will return the environment to what it once was, not in our lifetime, not in our children's lifetime. Your proposal is endangering not only the livelihood of local communities and their inhabitants, but also a threat to the very ecosystem that sustains all life here on earth.

Response
If there was an accident involving shipments of spent nuclear fuel or high-level radioactive waste to a repository, the response time would be the same as it would for any transportation accident. Funds provided under Section 180(c) of the NWPA would help emergency responders prepare for any accidents involving these shipments. If additional resources, over and above what are available locally, were needed the state or tribe could request them from various Federal agencies.

It is extremely unlikely an accident involving shipments to the repository would result in the release of spent nuclear fuel or radioactive waste. The Nuclear Regulatory Commission regulates the design, construction, use, and maintenance of shipping containers or casks for shipments of spent nuclear and high-level radioactive waste. The casks must be designed to withstand a series of impact, puncture, and fire environments, thereby providing reasonable assurance that packages would withstand serious transportation accidents. As discussed in Appendixes J and M of the EIS (see Section M.4.1), most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not be likely to result in release of radioactive materials from the shipping casks. A study conducted for the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000)

estimated that less than 0.01 percent of accidents would result in a release of radioactive material from a shipping cask that met the requirements of regulations in 10 CFR Part 71. These regulations ensure that the casks would be extremely robust. Chances of contaminating major drainages and waterways following a rail or truck accident would be extremely unlikely. Section M.4.1 contains additional information on cask safety and testing.

8.10.2 (4242)
Comment - EIS001160 / 0057
Transportation routes identified by the State of Nevada and evaluated in Appendix J go through White Pine County's most populated area and county seat, Ely. Here, ninety percent of the County's population exists within a 15 mile radius of the Ely city center and proposed transportation route. The main highway to the southwest goes five miles uphill along a winding, mountainous two lane route to Murry Summit (which is 7,300 feet high) passing within yards of the main water supply for the city. For six to eight months of many years, U.S. Hwy 6 is often icy and snow covered. It is not unusual for emergency first responders to take an hour to reach an accident site on any major highway because of the distances involved. If any highway is closed there are limited alternatives for routing traffic. The resulting economic impact could be devastating. Fog and snow can and has closed the only airport. The only hospital has limited capabilities. Volunteers are relied upon for fire and EMS [emergency medical support] resources. The DEIS does not adequately address these issues. The FEIS should include an assessment of unique circumstances impacting upon effective emergency first response in White Pine County.

Studies need to be undertaken to provide accurate assessments for those who are making transportation decisions concerning this area. Resources are limited and often inadequate without adding another demand on them. Money needs to be provided to increase the capabilities to specified levels and it must be provided to maintain those levels. Communications systems, support facilities, shelters, training and equipment, as well as qualified personnel are really inadequate to handle any serious accident. If a decision is made to route radioactive wastes through the county the costs associated with providing proper health and safety response agencies must be considered. There are some problems which money cannot solve. The DEIS then, must consider a combination of mitigation and compensation if risk management through effective emergency first response is to occur.

Before any decision is made concerning routing shipments through White Pine County a thorough assessment needs to be conducted and the results conveyed to those who will make the decision. This information, if not contained within the FEIS, should be a component in a subsequent supplement to the FEIS.

Carrier and shipper responsibilities and emergency response procedures require that response entities have a response team on call 24 hours a day. Will DOE and its carriers require/request 24 hour response capabilities of local first responders? The regulations at 10 CFR, Part 73, govern special safeguards. These regulations specify that transport vehicles carry personal communications devices. The DEIS should evaluate the extent to which such devices will function in rural Nevada and the extent to which rural emergency first responders have compatible communications capabilities. Of particular concern is the extent of communication "dead spots" located in areas of high accident hazard (i.e. canyons). Measures to mitigate communication deficiencies should be identified and evaluated within the DEIS (i.e. repeaters). The DEIS should recognize that communications would be helpful to situation assessment. Keeping in mind that there is a lot of highway area and distance to travel, emergency first responders would benefit from knowing what was occurring at the incident before these Emergency Response Teams from White Pine County arrive. The FEIS should consider what enhancements in local communications capabilities would be required to facilitate such communication. The FEIS needs to include more investigation, study and planning if transportation is to be safe for both the environment and the communities within White Pine County.

Response
As discussed in Section J.1.2.2 of the EIS, DOE has not yet determined the specific modes or routes it would use to ship spent nuclear fuel and high-level radioactive waste to the proposed repository. During the period before shipments could begin, many factors affecting route designation could change. As discussed in Section J.1.2.2, DOE evaluated potential alternate highway routes the State of Nevada could designate to assess the sensitivity of impacts that could occur in the State and nationally. Additional information on procedures and protocols on how routes would be eventually selected is provided in Section M.3.2.

Under current DOE planning, operation of a transportation system would be conducted by Regional Servicing Contractors under the procedures and protocols outlined in the request for proposals summarized in Section M.3.2 of the EIS. These protocols implement the multitude of requirements promulgated in U.S. Department of Transportation and Nuclear Regulatory Commission regulations, including security, safety, and communications.

As outlined in the DOE Draft Policy and Procedures for implementing Section 180(c) of the NWPA, eligible state and Native American jurisdictions would receive a one-time planning grant of $150,000 to conduct an assessment of their needs for safe routine transportation and emergency response. Additional technical assistance and funds for training would be provided by the Department for local emergency responders. Additional information on the provisions of Section 180(c) Policy and Procedures is provided in Section M.6 of the EIS.

States and tribes are primarily responsible for the health and safety of their citizens and would set the requirements for availability of first responders in their jurisdictions. For the purposes of communication, DOE intends to use satellite tracking communications and to make this equipment and training on the equipment available to all eligible jurisdictions after receiving Nuclear Regulatory Commission approval that the use of the satellite tracking technology does not violate Commission safeguards s and security regulations. Satellite tracking has been used successfully throughout the country regardless of the length of highway area and the far distances.

8.10.2 (4790)
Comment - EIS001475 / 0007
So this transportation, this is what is going to happen. There's no emergency response, either. On our reservation we only have one fire hydrant for our emergency response.

DOE won't admit to accidents. They're not going to let the public know who get affected. And these people, where they have these skills, you know, they're not going to drive a mile. That's what we say, how safe it is. How about the future generations, generations down the road? Will they be affected? I'm sure they will.

Response
Based on the analysis presented in the EIS, DOE believes the impacts from shipments of spent nuclear fuel and high-level radioactive waste to the proposed repository would be low. The impacts from incident-free transportation as well as from accidents are discussed in Appendix J of the EIS. It should be noted that of the thousands of shipments of these materials over the last 30 years, none has resulted in an identifiable injury through the release of radioactive material. As discussed in Appendixes J and M (see Section 4.2), most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not likely result in release of radioactive materials from the shipping casks. A study conducted for the U.S. Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000) estimated that less than 0.01 percent of accidents would result in a release of radioactive material from a shipping cask that meets the requirements of regulations in 10 CFR Part 71. These regulations ensure that the casks would be extremely robust.

Under Section 180(c) of the NWPA, DOE is required to provide technical assistance and funds to states for training public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions it would make shipments of spent nuclear fuel and high-level radioactive waste to a repository. Additional information on Section 180(c) is provided in Section M.6 of the EIS.

DOE anticipates providing financial and technical assistance to eligible jurisdictions at least 5 years before the commencement of shipments to a repository.

8.10.2 (5067)
Comment - EIS001441 / 0055
Transportation routes identified by the State of Nevada and evaluated in Appendix J go through White Pine County's most populated area and county seat, Ely. Here, ninety percent of the County's population exists within a 15 mile radius of the Ely city center and proposed transportation route. The main highway to the southwest goes five miles uphill along a winding, mountainous two lane route to Murry Summit (which is 7,300 feet high) passing within yards of the main water supply for the city. For six to eight months of many years, U.S. Hwy 6 is often icy and snow covered. It is not unusual for emergency first responders to take an hour to reach an accident site on any

major highway because of the distances involved. If any highway is closed there are limited alternatives for routing traffic. The resulting economic impact could be devastating. Fog and snow can and has closed the only airport. The only hospital has limited capabilities. Volunteers are relied upon for fire and EMS [emergency medical support] resources. The DEIS does not adequately address these issues. The FEIS should include an assessment of unique circumstances impacting upon effective emergency first response in White Pine County. The Ely Shoshone Tribe is not adequately prepared for any emergency response situations. The Ely Shoshone Tribe currently relies on the White Pine County emergency response team.

Studies need to be undertaken to provide accurate assessment for those who are making transportation decision concerning this area. Resources are limited and often inadequate without adding another demand on them. Money needs to be provided to increase the capabilities to specified levels and it must be provided to maintain those levels. Communications systems, support facilities, shelters, training and equipment, as well as qualified personnel are really inadequate to handle any serious accident. If a decision is made to route radioactive wastes through the county the costs associated with providing proper health and safety response agencies must be considered. There are problems which money cannot solve. The DEIS then, must consider a combination of mitigation and compensation if risk management through effective emergency first response is to occur.

Before any decision is made concerning routing shipments through the Ely Shoshone Reservation and White Pine County a thorough assessment needs to be conducted and the results conveyed to those who will make the decision. This information, if not contained within the FEIS, should be a component in a subsequent supplement to the FEIS.

Carrier and shipper responsibilities and emergency response procedures require that response entities have a response team on call 24 hours a day. Will DOE and its carriers require/request 24-hour response capabilities of local first responders? The regulations at 10 CFR, Part 73, govern special safeguards. These regulations specify that transport vehicles carry personal communications devices. The DEIS should evaluate the extent to which such devices will function in rural Nevada and the extent to which rural emergency first responders have compatible communications capabilities. Communications would be helpful to situation assessment. Keeping in mind that there is a lot of highway area and distance to travel emergency first responders would benefit from knowing what was occurring at the incident before what Emergency Response Teams from White Pine County arrive. The FEIS should consider what enhancements in local communications capabilities would be required to facilitate such communication. The FEIS needs to include more investigation, study and planning if transportation is to be safe for both the environment and the communities within White Pine County.

Response

As discussed in Section J.1.2.2 of the EIS, DOE has not yet determined the specific modes or routes it would use to ship spent nuclear fuel and high-level radioactive waste to the proposed repository. During the period before shipments could begin, many factors affecting route designation could change. . As discussed in Section J.1.2.2, DOE evaluated potential alternate highway routes the State of Nevada could designate to assess the sensitivity of impacts that could occur in the State and nationally. At the time of selection, the Department would initiate consultations with responsible State, tribal, and local authorities to assess potential impacts and appropriate mitigative measures. Additional information on procedures and protocols on how routes would be eventually selected is provided in Section M.3.2.

Under current DOE planning, operation of a transportation system would be conducted by Regional Servicing Contractors under the procedures and protocols outlined in the request for proposals summarized in Section M.3.2 of the EIS. These protocols implement the multitude of requirements promulgated in U.S. Department of Transportation and Nuclear Regulatory Commission regulations, including security, safety, and communications, and require consultations with responsible agencies.

As outlined in the Draft Proposed Policy and Procedures for implementing Section 180(c) of the NWPA, eligible state and tribal jurisdictions (those through which NWPA shipments would pass) would receive a planning grant of $150,000 to conduct an assessment of their needs for safe routine transportation and emergency response. Additional technical assistance and training would be provided by the Department for local emergency responders. Additional information on the provisions of Section 180(c) Policy and Procedures is provided in Section M.6 of the EIS.

States and tribes are primarily responsible for the health and safety of their citizens and would set the requirements for availability of first responders in their jurisdictions. For the purposes of communication, DOE intends to use satellite tracking communications and to make this equipment and training on the equipment available to all eligible jurisdictions after receiving Nuclear Regulatory Commission approval that the use of the satellite tracking technology does not violate the Commission's safeguards and security regulations. Satellite tracking has been used successfully throughout the country regardless of the length of highway area and the far distances.

8.10.2 (5276)
Comment - EIS000968 / 0001
The transportation of high-level nuclear waste through our County is of grave concern, and requires major planning to prepare for, respond to, and safely mitigate any accidents that may occur. Our review of the Draft Environmental Impact Statement (DEIS) leaves us with many more questions than answers, and makes planning virtually impossible. Therefore:

The Clark County Local Emergency Planning Committee (LEPC) believes the Yucca Mountain Draft Environmental Impact Statement is an insufficient analysis of the impacts of the Yucca Mountain Project on Clark County because it fails to provide specific detail about the Maximum Reasonably Foreseeable Accident and because it fails to describe how Section 180c of the Nuclear Waste Policy Act as Amended (NWPAA) will be implemented.

Response
Sections 6.2.4 and J.1.4.2.1 of the EIS describe the maximum reasonably foreseeable accidents analyzed in the EIS. The information in Appendix J has been updated and expanded to reflect the findings of a recent study, *Reexamination of Spent Fuel Risk Estimates* (DIRS 152476-Sprung et al. 2000).

In response to comments on the Draft EIS, additional information has been provided in Section M.5.1 of the EIS on the proposed operational aspects of spent nuclear fuel and high-level radioactive waste transportation, emergency response planning, and in Section M.6 for financial assistance programs. Section 180(c) of the NWPA requires DOE to provide technical and financial assistance to states and tribes to train public safety officials in emergency response and safe routine transportation. As a result of this program first responders would likely have sufficient training to be knowledgeable of the hazards to which they could be exposed from spent nuclear fuel and high-level radioactive waste shipments. Part of the Section 180(c) funds are for planning and coordination activities. States and tribes may use a percentage of the funding to purchase equipment for training purposes, which may then be used for emergency response, if necessary. States and tribes may request additional support from various Federal agencies in the event of an incident.

A draft Proposed Policy and Procedures for implementing the requirements of Section 180(c) was issued in 1998. A final Policy and Procedures would be issued if a repository site was approved.

8.10.2 (5520)
Comment - EIS001660 / 0034
Discussion of transportation emergencies, emergency assistance, emergency response, and carrier and shipper responsibilities is vague, misleading, and inadequate (p. 6-30). No consideration is given, to local jurisdictions choosing not to respond to radiological incidents, that them may not have the capabilities to respond even if assistance and training are available, or that limited emergency response may itself create impacts. Specifically:

The statement that "DOE would, as requested, assist state, tribal and local governments in several ways to reduce consequences of accidents related to the transportation of (SNF [spent nuclear fuel] and HLW [high-level radioactive waste])" (p. 6-30) does not provide sufficient information regarding the adequacy of emergency response capabilities;

Although DOE may provide assistance to state, local and tribal governments, this assistance may not be adequate for necessary emergency responses;

There is no guarantee or assurance that DOE assistance is forthcoming.

The statement that "(u)nder Section 180(c) of the NWPA, the Department would provide technical assistance and funding to train state, local, and tribal public safety officials" does not completely address the need for, or potential effectiveness of training of emergency responders; does not address whether such training is even desired by all jurisdictions; does not make it clear that the money is granted only to states; or does not even identify an amount. Potential assistance under Section 180(c) does not constitute assistance needed to help local jurisdictions deal with transportation emergencies, and the DEIS does not analyze whether it is the only assistance needed by state, local, and tribal governments.

The statement the DOE would require its transportation contractors to comply with the ANSI [American National Standards Institute] standard for carrier and shipper responsibilities and emergency response procedures does not adequately cover the need to discuss carrier and shipper responsibilities. The reference to carriers' and shippers' responsibilities for preparation of an emergency response plan, provision of information and assistance to emergency responders, and resources for dealing with the consequences of an accident fails to analyze whether these requirements would lessen the impacts of the proposed action and any of its alternatives.

The discussion of transportation emergencies does not fully address the local emergency response that would be expected or required, even if federal or private response resources were available and dispatched. Also, it does not identify constraints on local emergency response or the consequences of prolonged delays due to lack of local resources.

Response

States and tribes are primarily responsible for the health and safety of their citizens. However, in the event of an accident that released radioactive materials, a state or tribe could request assistance from Federal agencies under the Federal Radiological Emergency Response Plan and Federal Radiological Monitoring and Assessment Plan. DOE has several assets that could assist including the Radiation Emergency Assistance Center/Training Site (REAC/TS). REAC/TS is on call 24 hours a day to provide direct or consultative help with medical and health physics problems associated with an accident or incident involving radioactive materials.

Regarding the concern about jurisdictions refusing to respond to emergencies, it is the intent of Section 180(c) of the NWPA that first responders would be sufficiently trained to respond safely to an incident involving the shipment of spent nuclear fuel and high-level radioactive waste. In addition, the Emergency Planning and Community Right-to-Know Act mandates the formation of emergency planning and response capability by states. Under this provision, emergency responders cannot simply refuse to respond to an emergency.

Regarding the adequacy of assistance for emergency responses, DOE has published several *Federal Register* notices outlining its intentions regarding technical and financial assistance for states and tribes for training. Interested parties have had numerous opportunities to comment on these notices. The majority of commenters have indicated that training to the awareness-level for emergency response and inspector training for safe routine transportation is adequate preparation for shipments of spent nuclear fuel and high-level radioactive waste. In addition, as stated in the *Federal Register* notices, DOE would provide funding for equipment and additional technical assistance under Section 180(c), as requested. Additional information on the provisions of Section 180(c) is provided in Section M.6 of the EIS.

Regarding the assurance that the assistance from DOE would be forthcoming, the Department is required under Section 180(c) of the NWPA to provide technical and financial assistance for training in safe routine transportation and emergency response. The assistance mandated by that section would be provided at least 4 years before shipments began. This is the timeframe committed to by the Department on numerous occasions in numerous public forums and publicly issued documents.

The *Federal Register* notices make it clear that the funding would go to states and tribes. Local governments would not be eligible to receive Section 180(c) grants directly. However, states and tribes, if they have subjurisdictions, would have to coordinate their planning with local jurisdictions, indicating in the application that the needs of local public safety officials have been considered and how the training assistance would be provided to local jurisdictions and their appropriate public safety officials.

The Draft RFP for acquisition of Regional Servicing Contractors (DIRS 153487-DOE 1998) outlines the responsibilities, processes, and protocols for planning and operation of the transportation system. Though it focuses in detail on these responsibilities, it identifies other related responsibilities. Additional information on the responsibilities and processes is provided in Section M.3.2 of the EIS. For a more detailed discussion of roles and responsibilities of local, State, and Federal emergency responders, see Section M.5.1.

Regarding constraints on local emergency response, DOE places no constraints on emergency responders and feels that the Draft Policies and Procedures for implementing Section 180(c) of the NWPA are adequate to prepare states, tribes, and local governments for emergency situations.

8.10.2 (5718)
Comment - EIS001887 / 0331
Page 6-37; Section 6.3 - Nevada Transportation

The assessment of socioeconomic impacts associated with Nevada transportation fails to address impacts on State and local governments. Specifically, any response to an incident, accident, or even a simple vehicle breakdown will impact a large group of responders. The Draft EIS does not discuss facilities, equipment, and mitigation, etc. that will be required. It refers only to the transporter's responsibilities regarding these issues, not the impact on public safety (response) agencies. Some of the issues are:

- Availability of equipment to deal with the large (size and weight) transportation casks in the event of vehicle breakdowns, load shifting, accidents, etc.; and

- Response costs for breakdowns and incidents/accidents. Timely responses would require staged equipment, trained and equipped personnel, and the associated infrastructure to support them.

Response
In accordance with the draft RFP for the Acquisition of Waste Acceptance and Transportation Services for the Office of Civilian Radioactive Waste Management (available at *www.rw.doe.gov/wasteaccept/wasteaccept.html*), transportation contractors would be responsible for providing a Transportation Plan addressing, among other things, the handling and correction of off-normal events. The contractor would provide the drivers and crews with specific written procedures clearly defining detailed actions to be taken in the event of an off-normal event. These procedures would address repair or replacement of equipment, or recovery, as appropriate. These requirements would be applicable to transport by truck and rail. If an accident occurred at an intermodal transfer station, the contractor operating that facility would be responsible for providing the necessary cleanup and recovery equipment.

Regarding the concern about response times, if there was an incident involving shipments of spent nuclear fuel and high-level radioactive waste, shipment drivers and escorts would be on the scene and trained to respond until local authorities arrived. Local first responders would respond in the same period that they would respond to any emergency. Section 180(c) funds would help them prepare for this type of emergency. Given the integrity of the casks transporting the waste, and the fact that more than 2,700 shipments of spent nuclear fuel have been safely transported in the last 30 years with no fatalities, injuries, or environmental damage caused by the radioactive nature of the cargo, the chances of contamination of local communities and the environment from an incident involving this type of waste are extremely unlikely and not expected to occur. DOE feels that this waste can, indeed, be transported safely.

The training of public officials who could be called upon to respond to an accident or incident involving shipments to a repository would be funded under Section 180(c) of the NWPA. Additional information on this issue is contained in Section M.6 of the EIS.

8.10.2 (5824)
Comment - EIS001728 / 0002
Require the shippers not only to notify the state government's office, but also that the emergency responders along the route have to have a general idea when this is coming through. At two o'clock in the morning when the responders respond, they need to know what they're dealing with and what they may encounter. They also -- that during the early stages of shipment when the campaign starts, we feel that a tail escort, knowledgeable person, escort

this material to give the incident commander adequate information, have instrumentation to be able to help the incident commander decide if there is a problem and how to handle it. We feel that later on that we'll be able -- you could be able to probably eliminate that escort.

Most importantly, emergency response forces along the route must be trained to deal with an emergency, should one occur. We believe that currently there is adequate training programs available on the subject, but we fear that these programs may go too far in-depth into the subject matter and will never reach the core group of responders who need them. Training should be self-sustaining, it should be simple, it should be fairly shipment-specific so the people understand, and it's got to get to the people on the street. It's got to get to those on the local level. All too often we develop great programs and they end up at the state level and they never get to the people on the street, so we're very much in favor of some legislation that will make sure that the responders along the route get that education.

Response
DOE is required by the Nuclear Regulatory Commission (10 CFR 71.97) to notify the state or tribal designated point of contact. It is the state or tribal representative's responsibility to coordinate with local officials and emergency responders. The emergency responders would receive information about the shipments of spent nuclear fuel and high-level radioactive waste before they reached their jurisdictions through various means. In addition to the advance notification, DOE would conduct dialogues with state and tribal authorities regarding projected shipments. DOE would also track the shipments through a satellite tracking system such as the TRANSCOM system, which would be available to states and tribes if the Nuclear Regulatory Commission determined that it did not violate safeguards and securities regulations. As required by the U.S. Department of Transportation (49 CFR Part 172), the vehicle would be properly placarded and the containers marked so that emergency responders would have knowledge of the cargo. The carrier would possess shipping papers describing the cargo contents.

Regarding the issue of training, DOE would provide financial assistance for training emergency responders at least 5 years before the commencement of shipments of spent nuclear fuel and high-level radioactive waste. As indicated in Section 180(c) of the NWPA, states and tribes, in coordination with local public safety officials, would determine who received training to the awareness level. The regulation clearly provides that the emergency responders on the local level should be trained. See Section M.6 of the EIS for additional information regarding Section 180(c).

Shipments of spent nuclear fuel and high-level radioactive waste would be physically protected by trained personnel as required by the Nuclear Regulatory Commission requirements (10 CFR 73.37). Additional information regarding physical protection of shipments in provided in Section M.7 of the EIS.

8.10.2 (6405)
Comment - EIS001114 / 0001
I would have to assume transport by road is the safest way to go so the only thing I would suggest is that all of the municipalities this convoy goes through takes part in safe passage with one or two fire trucks equipped with hazardous waste spill material and also a police escort front and rear with co-op from Ill, state Police and the Feds, under this controlled situation can you create the safe transportation that will be needed.

Response
The transportation of spent nuclear fuel and high-level radioactive waste by either truck or rail is considered safe. Of the thousands of shipments completed over the last 30 years, none has resulted in an identifiable injury through release of radioactive material. DOE plans to use rail where possible to reduce the number of shipments.

The Nuclear Regulatory Commission requires shipments to be escorted for security reasons, but there is no requirement for them to be escorted by emergency response personnel. It is believed that, in the event of an emergency, state, tribal, and local emergency response capabilities would be able to respond effectively. Technical assistance and funds for training these emergency response assets are available from DOE through the provisions of Section 180(c) of the NWPA. Additional information on these issues can be found in Section M.6 of the EIS.

8.10.2 (6428)
Comment - EIS001819 / 0002
The City [Kirkwood, Missouri] recommends, at a minimum, that local emergency management officials and fire chiefs be notified in advance of shipments passing through Kirkwood; local fire and emergency management personnel be provided training and procedures to follow in the event of an accident; and that, rail cars be adequately marked as to their radioactive contents.

Response
As stated in Section 2.1.3 of the EIS, DOE would comply with all applicable regulations of the U.S. Department of Transportation and the Nuclear Regulatory Commission (NRC). As required by NRC regulations (10 CFR Part 73), the state's and tribe's designated points of contact would receive advance notification regarding shipments of spent nuclear fuel and high-level radioactive waste. It is the responsibility of the states and tribes to notify local emergency management officials and fire chiefs. This notification process is discussed in Section M.3.2.2.1 of the EIS. The contractor providing transportation services to DOE would be required to have an Emergency Response Plan that provided for appropriate notifications to Federal agencies and state, tribal, and local units of government in the event of an emergency. Continuous real-time tracking of all shipments to the repository would provide the location of any incident.

As required by Section 180(c) of the NWPA, local fire and emergency management personnel would receive funding for training through their states and tribes. Additional information on emergency response and provisions of Section 180(c) is provided in Sections M.5.1 and M.6 of the EIS, respectively.

Railcars would be placarded when transporting radioactive materials consistent with U.S. Department of Transportation regulations (49 CFR Part 172).

8.10.2 (6505)
Comment - EIS001774 / 0011
During an accident who's in charge? Where are the evaluations of costs, risks and route-specific data on possible accidents, population density, weather?

Response
As discussed in Section M.5.1 of the EIS, according to the Federal Radiological Emergency Response Plan, state and local governments have the primary responsibility for determining and implementing measures to protect life, property, and the environment, with support provided, upon request, by Federal agencies, including DOE. State and local governments deal with transportation accidents involving hazardous materials on a daily basis across the United States. According to the Notice of Revised Proposed Policy and Procedures, DOE would provide funding and technical assistance to states and tribes along transportation routes to address incremental training requirements resulting from shipments of spent nuclear fuel and high-level radioactive waste to the repository. DOE would allow a variety of activities an applicant state or tribal jurisdiction might consider appropriate for training under the Section 180(c) program. Along a specific transportation route, it would be the applicant's decision as to who received training.

Section J.1.4.2 of the EIS discusses the methods and data used to evaluate the risks and consequences to populations and individuals of transportation accidents. This section includes discussions of the population density data, accident rate data, and the weather conditions used in the analyses. The risks and consequences associated with transportation accidents are summarized Sections 6.2.4.2.1 and 6.2.4.2.2. As discussed in these sections, radiological risks to populations within 80 kilometers (50 miles) of an accident ranged from about 0.5 person-rem for the mostly legal-weight truck scenario to 1 person-rem for the mostly rail scenario. The consequences to the population of maximum reasonably foreseeable, but highly unlikely, transportation accidents ranged from about 1,100 person-rem for the mostly legal-weight truck scenario to about 9,900 person-rem for the mostly rail scenario.

A review of previous estimates of the costs associated with severe transportation accidents have been added to Appendix J of the EIS. These costs ranged from $200,000 to an estimate by the State of Nevada of $270 billion. The extreme costs estimated in some analyses are based on consequences estimated using extremes of estimates for all parameters in the analysis and are considered not reasonably foreseeable and therefore not useful for decisionmaking. Furthermore, DOE believes that estimating the costs associated with severe, but highly unlikely,

transportation accidents requires a high degree of speculation and that speculation of this kind is not required by the National Environmental Policy Act.

8.10.2 (6566)
Comment - EIS001632 / 0053
The EIS recognizes the need to prepare for and respond to accidents. Page 6-30 highlights Section 180(c) of the NWPA under which DOE will provide technical assistance and funding to state, local and tribal public safety programs on transportation emergencies. This page also describes how transportation contractors must prepare an emergency response plan and take other steps to deal with the consequences of accidents.

Response
Thank you for your comment. Information presented in Section M.5.1 of the EIS provides additional information related to emergency response planning and Section M.6 provides additional information on financial assistance programs.

8.10.2 (6697)
Comment - EIS001878 / 0063
The DEIS fails to adequately assess the potential public health and safety impacts of the proposed Carlin rail corridor and other corridors (pp. 6-11, -37, -39 to -41, -49, -63) in a number of important areas. (For additional discussion of this point, see the January 19, 2000, letter to the DOE from Eureka County's Local Emergency Planning Committee [LEPC].

Transportation of SNF [spent nuclear fuel] and HLW [high-level radioactive waste] through areas with limited emergency response capabilities, including Eureka County and much of rural Nevada, increases the risks associated with transportation incidents. Risks are higher because of the lack of initial response capability and the time delay for responding personnel. Some jurisdictions may choose not to respond to incidents involving SNF and HLW due to financial and personnel considerations. Jurisdictions with volunteer fire departments and other volunteer emergency responders may decide not to respond to incidents in which they cannot participate safely. The DEIS must address these scenarios.

The discussion of transportation emergencies, emergency assistance, emergency response, and carrier and shipper responsibilities is vague, misleading, and inadequate. (p. 6-30) It does not consider that local jurisdictions may choose not to respond to radiological incidents, that they may not have the capabilities to respond even if assistance and training are available, or that limited emergency response may itself create impacts. Specifically:

The statement that "DOE would, as requested, assist state, tribal and local governments in several ways to reduce consequences of accidents related to the transportation of [SNF and HLW]" (p. 6-30) does not provide sufficient information regarding the adequacy of emergency response capabilities;

Although DOE may provide assistance to state, local, and tribal governments, that assistance may not be adequate for necessary emergency responses;

There is no guarantee or assurance that assistance from the DOE will be forthcoming, or that it will be adequate;

The statement that "[u]nder Section 180(c) of the Nuclear Waste Policy Act, the Department would provide technical assistance and funding to train state, local, and tribal public safety officials" does not completely address the need for or potential effectiveness of training for emergency responders; address whether such training is even desired by all jurisdictions; make it clear that the money is granted only to states; or identify an amount;

Potential assistance under Section 180(c) does not constitute the universe of assistance needed to help local jurisdictions deal with transportation emergencies, and the DEIS does not analyze whether it is the only assistance needed by state, local, and tribal governments;

The statement that DOE would require its transportation contractors to comply with the ANSI standard for carrier and shipper responsibilities and emergency response procedures does not adequately cover the need to discuss carrier and shipper responsibilities;

The reference to carriers' and shippers' responsibilities for preparation of an emergency response plan, provision of information and assistance to emergency responders, and resources for dealing with the consequences of an accident fails to analyze whether these requirements would lessen the impacts of the proposed action or any of its alternatives;

The discussion of transportation emergencies does not fully address the local emergency response that would be expected or required, even if federal or private response resources were available and dispatched; and
The discussion of transportation emergencies does not identify constraints on local emergency response or the consequences of prolonged delays due to the lack of local resources.

Response
Public health and safety impacts as well as other impacts of each of the rail corridor implementing alternatives in Nevada are discussed in Section 6.3.2.2 of the EIS. States and tribes have the primary responsibility for the health and safety of their residents. The Federal Government supports the states and tribes when requested. At this time, with five rail corridors being evaluated in the EIS, specific public health and safety issues, including emergency preparedness and response, would not be addressed until a single corridor and alignment within the corridor was selected. The Department would then initiate National Environmental Policy Act activities for the chosen rail corridor/alignment, initiate consultations with Federal, state, and tribal authorities, and evaluate these specific considerations in detail in an attempt to mitigate as many potential impacts as possible.

It is the intent of Section 180(c) of the NWPA that first responders would be sufficiently trained to respond safely to an incident involving the shipment of spent nuclear fuel and high-level radioactive waste. DOE has committed to providing technical and financial assistance for training as mandated by Section 180(c) beginning approximately 4 years before shipments began. In addition, the Emergency Planning and Community Right-to-know Act mandates the formation of emergency planning and response capability by the states. The *Federal Register* notices make it clear that the funding would go to states and tribes. Local governments would not be eligible to receive Section 180(c) grants directly. However, states and tribes would be required to coordinate their planning with local jurisdictions, indicating in their applications that the needs of local public safety officials have been considered and describing how the training assistance would be provided to local jurisdictions and their appropriate public safety officials.

DOE recognizes that emergency preparedness capabilities and needs vary from jurisdiction to jurisdiction. To assist states and tribes to determine what their needs are and where the 180(c) funds and assistance can best be applied, DOE would provide a one-time planning grant to aid in making this determination. Additional discussion of Section 180(c) can be found in Section M.6 of the EIS.

In the event of an incident or accident involving radioactive materials, states, tribes, and local governments can request assistance from the Federal Government under the Federal Radiological Emergency Response Plan. Assistance is available from 17 different agencies. In addition, DOE maintains eight Regional Coordinating Offices across the country that are ready to provide assistance. Information concerning these resources can be found in Section M.5.1 of the EIS.

The Regional Servicing Contractor would be required to provide drivers and crews with specific written procedures that clearly define detailed actions to be taken in the event of an emergency or incident. The Draft Request for Proposals, *Acquisition of Waste Acceptance and Transportation Services for the Office of Civilian Radioactive Waste Management* (DIRS 153487-DOE 1998) focuses in detail on these responsibilities, as well as on other related responsibilities. Carrier and shipper responsibilities regarding emergency situations are discussed in Section M.5.1 of the EIS.

8.10.2 (8601)
Comment - EIS001837 / 0006
Upon a cursory review of your Draft DEIS it became apparent that if the DOE intends to go forward with this, DOE needs to rewrite and circulate the DEIS because it is inadequate, deficient and fatally flawed in the following ways:

1. No Evacuation Plan or Contingency Plan has been proposed and no alternative routes across the California Desert Conservation Area (the East Mojave) and through Needles, California have been assessed. This is akin to putting in a huge housing development in, with only one road to go in and out on and no fire escape route. Obviously, if alternate routes are assessed for this major proposal of massive shipments of the most lethal materials known to humanity, the DOE would be forced to include California Environmental Quality Act (CEQA) regulations and write a Environmental Impact Report meeting the requirements of CEQA regulations. In other words, your DEIS should be an DEIS/R. It is no wonder that you held only one meeting in Lone Pine, California. The DOE was obviously playing hide and seek from the People of the State of California.

Response
The preparation and implementation of evacuation and contingency plans is a state or tribal responsibility. Section 180(c) of the NWPA provides funds to eligible jurisdictions for the preparation of these plans as well as emergency response and safe routine transportation planning and coordination activities.

The routes used in the transportation analyses in the EIS are routes that are representative of ones DOE could use to make shipments to a Yucca Mountain Repository. DOE has not selected routes that it would propose to use. At least 4 years prior to the first shipments, DOE plans to notify affected states of preliminary routes it could use. See Section M.6 of the EIS for more information on Section 180(c) and Sections M.3.2.2 and M.5 for more information on emergency response.

8.10.2 (8831)
Comment - EIS001834 / 0014
The DEIS fails to identify what emergency response personnel training and equipment would be needed in all of the communities along the transportation routes. Many communities' emergency responders lack the special equipment and training necessary to respond to a radiological accident. Further, many hospitals do not have isolation rooms for radioactively contaminated victims. This analysis should at the very least be done for the major population centers along the transportation routes (populations of 100,000 or more). The DEIS should indicate what emergency response equipment, facilities, and trained personnel are available in these communities, and what the effects of a transportation accident could be based on what is currently available. For instance, if an accident occurs, and the driver of a nuclear waste truck is radiated, and there is no isolation room in the hospital, what are the impacts?

Response
State, tribal, or local governments must make the determination as to whether a jurisdiction has adequate emergency response capabilities. To aid in this process, a one-time planning grant will be available to eligible jurisdictions under Section 180(c) of the NWPA. In addition, technical assistance and funds will be made available under the provisions of this section for training of public safety officials. Section M.6 of the EIS provides additional information concerning Section 180(c).

In addition to the assistance available under Section 180(c), specific advice and support in the handling of individuals who might have been contaminated in an incident involving radioactive materials can be obtained 24 hours a day from the DOE Radiation Emergency Assistance Center/Training Site (REAC/TS).

The analysis of impacts of transportation accidents in the EIS (see Section J.1.4.2.1 for a discussion of methods and assumptions used) does not take credit for emergency response efforts to reduce exposure to individuals. Therefore the impacts represent what could happen regardless of the emergency response capabilities of jurisdictions along transportation routes. Federal- and state-supported training for responding to accidents involving hazardous materials, including radioactive materials, as well as training that would be supported by DOE for repository shipments, makes it unlikely that a first responder would receive a dose as high as that estimated in the EIS for a maximally exposed individual. The estimated doses from accidents to maximally exposed individuals in Section 6.2.4.2 are high estimates for maximum reasonably foreseeable accidents that could occur, which would have a likelihood of occurring between once in 1 million years and once in 10 million years. These doses were estimated

with the assumption that a maximally exposed individual would be present for the full duration of an accident at the location where exposure to radioactive materials in the air and on the ground would lead to the maximum dose that could occur. The doses for a legal-weight truck accident and for a rail accident would be 0.75 rem and 29 rem, respectively, for the maximally exposed individuals. In addition, DOE has included estimates of the dose to an emergency responder to a severe accident. The largest estimated dose for a first responder would be 0.83 rem. This dose is estimated for a first responder to a severe rail accident where a portion of the cask's lead shield had been displaced. This dose, which is less than the administratively imposed annual limit of 2 rem for DOE's radiation workers, would lead to an estimated increase in the risk of a latent fatal cancer of about 3.3 in 10,000 over the individual's lifetime.

8.10.2 (8987)
Comment - EIS001040 / 0022
Where will Missouri's accident response center be located?

Response
Each state is responsible for the health and safety of its people. Therefore, any decisions concerning an accident response center are left to each individual state. As stated in Chapter 2 of the EIS, consistent with the provisions of Section 180(c) of the NWPA, DOE would provide technical assistance and funds to states and tribes for training local public safety officials in the areas of safe routine transportation and emergency response, but it will not dictate to states and tribes where they are to locate any accident response centers. Additional information on emergency response responsibilities and capabilities and the provisions of Section 180(c) is provided in Sections M.5.1 and M.6 of the EIS, respectively.

8.10.2 (9434)
Comment - EIS001888 / 0124
The DEIS failed to consider local and regional conditions with regard to communication among agencies in emergency situations. Any discussion of mitigation, support or compensation must address the development and maintenance of an adequate communication system for a transportation incident involving radioactive waste. The system must include such aspects as area of coverage, interagency arrangements, and backup systems.

Response
The communications needed in response to an incident involving radioactive waste would be no different than that needed to deal with any transportation incident or accident. However, in addition to the equipment that states, tribes, and local governments have in place to deal with other public safety emergencies, DOE plans to use a satellite tracking system such as TRANSCOM to track and provide communications for shipments to a repository (Section M.3.2.1.5). As outlined in Section 180(c) of the NWPA (see Section M.6 of the EIS), DOE would provide funding for equipment and training on the satellite tracking system to states and tribes to allow them access to these communications (if the Nuclear Regulatory Commission approves). DOE would provide funding for states and tribes to coordinate with local public safety officials in the areas of emergency response and communications.

8.10.2 (9457)
Comment - EIS001888 / 0134
DEIS Statement (pg. 240) 2.1.3.2 - In the event of an accident involving a shipment of spent nuclear fuel or high-level radioactive waste, the transportation vehicle crew would notify local authorities and the central communications station monitoring the shipment. DOE would make resources available to local authorities as appropriate to mitigate such an incident.

Clark County Comment - The DEIS stated that "DOE would make resources available to local authorities as appropriate to mitigate" an incident. It did not explain how or when such assistance will be made available. Will local governments and the State of Nevada be burdened with the front-end costs of an incident and have to wait for reimbursement from DOE. If a significant incident occurred, it could be beyond the financial resources of a local entity. The DEIS should clearly state that the DOE will pay for any incident and pay for it up front. NEPA [National Environmental Policy Act] Regulation: Sec. 1502.1 Purpose; Sec. 1502.22 Incomplete or unavailable information.

Response
As discussed in Section M.5.1 of the EIS, states and tribes are primarily responsible for the health and safety of their citizens. However, Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for determining the need for and training of public safety officials of appropriate units of local government and tribes through whose jurisdictions the Department would ship spent nuclear fuel and high-level radioactive waste. This training would cover procedures for dealing with incident-free transportation and emergency response situations. It would be up to state, local, and tribal authorities to determine who would receive training and what equipment would be required. DOE would provide funds for training and the associated purchase of equipment for safe routine transportation and emergency response.

In addition, several Federal agencies have training and available capabilities should the states or tribes request them. If an accident with release of radioactive waste occurred, affected states and tribes could request assistance from DOE, Environmental Protection Agency, Department of Agriculture, Department of Health and Human Services, and the Federal Emergency Management Agency. These agencies, in cooperation with states, tribes, and each other, would monitor and assess radioactive materials in air, ground, agricultural products, and water in accordance with the Federal Radiological Emergency Response Plan and the Federal Radiological Monitoring and Assessment Plan. The costs for such services would be borne by the Federal agencies.

Costs associated with accidents would be borne by the transportation contractor's insurance and by coverage under the Price-Anderson Act. The Price-Anderson Act provides for indemnification of liability up to $9.43 billion to cover claims that might arise from an accident in which radioactive materials were released or one in which an authorized precautionary evacuation was made (see Section M.8 of the EIS for a more complete discussion of the Price-Anderson Act).

8.10.2 (9595)
Comment - EIS001888 / 0269
Incident Response

An essential concern for local governments is the speed and ability to respond to incidents. The DOE's requirement to reduce and mitigate the impact of a radioactive waste spill is an important part of the DOE's program. The DEIS should have discussed how the transportation system will be organized to enhance public safety respond to accidents. The DEIS should at least provide some information about the minimum incident response performance standards required of the RSCs [Regional Servicing Contractors].

Response
The first response to an incident during the transportation of radioactive materials is the responsibility of local officials in the jurisdiction where the incident occurs. Section M.6 of the EIS discusses DOE's responsibilities, as defined in Section 180(c) of the NWPA. That section states that DOE is required to provide technical and financial assistance to states and tribes for training public safety officials in jurisdictions through which it plans to transport spent nuclear fuel or high-level radioactive waste. Regional Servicing Contractors would be required to develop an Emergency Response Plan that addressed activities to be conducted by shippers and carriers in an accident or off-normal incident. The Plan would provide for a knowledgeable representative of the Regional Servicing Contractor to be at the scene as soon as possible after being notified by DOE to provide technical assistance. In addition, the Regional Servicing Contractor would be responsible for providing or having carriers provide drivers and crews with specific written procedures that clearly define detailed actions to be taken in the event of an emergency. Discussions of additional requirements imposed by Section 180(c) on DOE and the requirements imposed on the Regional Servicing Contractors by DOE are provided in Sections M.6 and M.3.2, respectively.

8.10.2 (9614)
Comment - EIS002075 / 0001
I especially brought to the attention of the tribes the matter of the emergency response and preparedness and how we, as tribes, are unprepared at this time and how the federal government and other agencies can look upon the tribes to assume that responsibility. And as was stated, we lack training. We lack staff. We lack equipment. We lack funds to be prepared for any kind of spills near us. And coming from an area where the President has just proclaimed close to our area, two national monuments; one is the Grand Staircase National Monument, and the other one is Grand Canyon, a national monument. As these are developed, there will be more visitors. There will be more

tourists. We will have more visitors from other countries. And tribes are expected to assume full responsibility for their safety when it comes to the use of our highways, our rail systems, and transportation of the waste products that are being sent to Yucca Mountain. Should there be a spill along the way, then our people are not going to be prepared to take care of that, although the general public will look upon us as assuming that responsibility. Then we're going to have environmental justice cases that probably will stem from those problems. So therefore, I think that the EIS needs to address our concerns on emergency response and preparedness and our environmental justice issues.

Response
Section 180(c) of the NWPA requires DOE to provide technical assistance and funds for emergency response training to states and tribes that would have shipments move through their jurisdictions on the way to a repository. A percentage of these funds may be used to obtain equipment. If additional resources are required to deal with an accident, assistance can be requested from Federal agencies. See Section M.6 of the EIS for additional information on Section 180(c) and emergency response.

It is the intent of Section 180(c) of the NWPA that first responders would be sufficiently trained to respond safely to an incident involving the shipment of spent nuclear fuel and high-level radioactive waste. The Department has committed to providing technical and financial assistance for training as mandated by Section 180(c) approximately 4 years before shipments commence. In addition, the Emergency Planning and Community Right-to-Know Act mandates the formation of emergency planning and response capability by the states. The *Federal Register* notices make it clear that the funding will go to states and tribes. Local governments will not be eligible to receive Section 180(c) grants directly. However, states and tribes would be required to coordinate their planning with local jurisdictions, indicating in the application that the needs of local public safety officials have been considered and how the training assistance will be provided to local jurisdictions and their appropriate public safety officials.

DOE recognizes that emergency preparedness capabilities and needs vary from jurisdiction to jurisdiction. To assist states and tribes to determine what their needs are and where the 180(c) funds and assistance can best be applied, DOE will provide a one-time planning grant to aid in making this determination. Additional discussion of Section 180(c) can be found in Section M.6 of the EIS.

In the event of an incident or accident involving radioactive materials, states, tribes, and local governments can request assistance from the Federal Government under the Federal Radiological Emergency Response Plan. Assistance is available from seventeen different agencies. In addition, DOE maintains eight Regional Coordinating Offices across the country that are ready to provide assistance. Information concerning these resources can be found in Section M.5.1 of the EIS.

The Regional Servicing Contractor would be required to provide drivers and crews with specific written procedures that clearly define detailed actions to be taken in the event of an emergency or incident. The Draft Request for Proposals, *Acquisition of Waste Acceptance and Transportation Services for the Office of Civilian Radioactive Waste Management* (DIRS 153487-DOE 1998), focuses in detail on these responsibilities, as well as on other related responsibilities. Carrier and shipper responsibilities regarding emergency situations are discussed in Section M.3.2.2.5 of the EIS.

Sections 4.1.13.4 and 6.1.2.12 of the EIS discuss the issue of environmental justice. The analysis in the EIS determined that the impacts from transportation to humans and other impacts that could affect populations of Native Americans would not be disproportionately high and adverse.

8.10.2 (9831)
Comment - EIS001888 / 0409
[Clark County summary of comments it has received from the public.]

Draft Comments on NOI [Notice of Intent] for Yucca [Mountain] EIS. Savings from delay of EIS could be used also to complete studies of fund distribution to state, local gov't, and tribes for ER [emergency response] preparedness and to clarify risk. Impact assessment approaches to be used by DOE.

Response
Section 180(c) of the NWPA authorizes DOE to provide funding and technical assistance for training of safety and emergency response personnel. Planning grants would be provided at least 4 years prior to commencement of shipments. This should allow sufficient time to prepare for shipments. In addition, states and tribes are allowed to use their initial planning grants to conduct risk assessment and other assessment activities. Section M.6 of the EIS provides additional information on the provisions and timing of Section 180(c) grants and funding. It is not necessary to delay work on the EIS, because sufficient time is built into the Section 180(c) implementation process to conduct these studies.

8.10.2 (10135)
Comment - EIS001865 / 0011
Section 2.1.3.2 of the EIS first acknowledges that the NWPA Section 180(c) requires DOE to provide technical and financial assistance to states and tribes for training public safety officials in jurisdictions through which [DOE] plans to transport spent nuclear fuel and high-level radioactive waste (page 2-40). In Section 6.2.4.2, Transportation Accident Scenarios, (page 6-30) the document clarifies that Section 180(c) also provides for "technical assistance and funding" to "local ... public officials." This inconsistency is confusing. Please clarify whether local assistance is mandated by law. If, in fact, local assistance is available, please consider this response letter as the County's request to be provided with this assistance, including funding.

Response
DOE agrees that the wording used in the text box could be confusing, and has revised Section 6.2.4.2 of the EIS accordingly. Local governments are not eligible to apply for Section 180(c) grants directly. However, states and tribes, if they have subjurisdictions, would be required to coordinate their planning with local jurisdictions, and indicate in their applications for Section 180(c) assistance that they have considered the needs of local public safety officials and describe how the training assistance would be provided to local jurisdictions and their appropriate public safety officials.

8.10.2 (10227)
Comment - EIS002115 / 0002
The DEIS does not adequately address specific community, local government, statewide and regional impacts. Rural counties do not have money to handle radioactive accidents. The cost to ensure that the rural counties would be able to accommodate the transportation of the radioactive waste would probably exceed the no action alternative, uncertainty used in models and data used for site characterization and repository performance.

Response
Section 180(c) of the NWPA requires DOE to provide technical assistance and funds for emergency response training to states and tribes that would have shipments move through their jurisdictions on the way to a repository. A percentage of these funds may be used to obtain equipment. If additional resources are required to deal with an accident, assistance can be requested from Federal agencies. See Section M.6 of the EIS for additional information on Section 180(c) and emergency response.

It is the intent of Section 180(c) of the NWPA that first responders would be sufficiently trained to respond safely to an incident involving the shipment of spent nuclear fuel and high-level radioactive waste. The Department has committed to providing technical and financial assistance for training as mandated by Section 180(c) approximately 4 years before shipments commence. In addition, the Emergency Planning and Community Right-to-Know Act mandates the formation of emergency planning and response capability by the states. The *Federal Register* notices make it clear that the funding will go to states and tribes. Local governments will not be eligible to receive Section 180(c) grants directly. However, states and tribes would be required to coordinate their planning with local jurisdictions, indicating in the application that the needs of local public safety officials have been considered and how the training assistance will be provided to local jurisdictions and their appropriate public safety officials.

DOE recognizes that emergency preparedness capabilities and needs vary from jurisdiction to jurisdiction. To assist states and tribes to determine what their needs are and where the 180(c) funds and assistance can best be applied, DOE will provide a one-time planning grant to aid in making this determination. Additional discussion of Section 180(c) can be found in Section M.6 of the EIS.

In the event of an incident or accident involving radioactive materials, states, tribes, and local governments can request assistance from the Federal Government under the Federal Radiological Emergency Response Plan. Assistance is available from 17 different agencies. In addition, DOE maintains eight Regional Coordinating Offices across the country that are ready to provide assistance. Information concerning these resources can be found in Section M.5.1 of the EIS.

The Regional Servicing Contractor would be required to provide drivers and crews with specific written procedures that clearly define detailed actions to be taken in the event of an emergency or incident. The Draft Request for Proposals, *Acquisition of Waste Acceptance and Transportation Services for the Office of Civilian Radioactive Waste Management* (DIRS 153487-DOE 1998), focuses in detail on these responsibilities, as well as on other related responsibilities. Carrier and shipper responsibilities regarding emergency situations are discussed in Section M.3.2 of the EIS.

8.10.2 (10305)
Comment - EIS001873 / 0082
Lincoln County Independent Research:

The County, under its federally funded Nuclear Waste Oversight Program, has produced numerous studies containing information concerning local impacts of the Yucca Mountain Project. As the County has stated in comments on the DEIS, the DOE has evidently not made any use of the County effort, which has cost approximately five million dollars to date. Following are some of the findings of the County studies. (My own observations are in parentheses.)

Lincoln County Emergency Preparedness Inventory 1992

Documents the County's lack of preparedness to handle accidents involving nuclear waste.

Response times in much of the county would be in excess of one hour.

In a preamble on local perception of risk the study notes that less than half of Caliente residents believe that radioactive waste can be transported safely.

Response
As stated in Section 2.1.3 of the EIS, DOE intends to comply with all applicable regulations of the U.S. Department of Transportation and the Nuclear Regulatory Commission in the transport of spent nuclear fuel and high-level radioactive waste. In addition, the Department would comply with all aspects of the NWPA. Section 180(c) of the Act would provide funding and technical assistance for training of safety and emergency response personnel at least 4 years prior to the commencement of shipments. This should allow sufficient time to prepare for the shipments. In addition, as stated in the Draft Policy and Procedures for Section 180(c) (see Section M.6 of the EIS), if the route for a shipment was selected too close to the start of the shipment to allow for Section 180(c) implementation or if for any reason the responsible jurisdictions along a selected route lacked adequate training, DOE could use escorts with more training and equipment than those normally used for the purpose of security until a reasonable period for training has expired.

Regarding the commenter's concerns about response times, if there were an incident involving shipments of spent nuclear fuel and high-level radioactive waste, shipment drivers and escorts would be on the scene and trained to respond until local authorities arrived. Local first responders would respond in the same time period that they would respond to any emergency. Section 180(c) funds would help them prepare for this type of emergency. Given the integrity of the casks transporting the waste, and the fact that more than 2,700 shipments of spent nuclear fuel have been safely transported in the last 30 years with no fatalities, injuries, or environmental damage caused by the radioactive nature of the cargo, the chances of contamination of local communities and the environment from an incident involving this type of waste are extremely unlikely and not expected to occur. DOE feels that this waste can, indeed, be transported safely.

In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in

predicting future behavior based on perceptions had advanced sufficiently since scoping to allow DOE to quantify the impact of public risk perception on economic development or property values in potentially affected communities (see Section 2.5.4 and Appendix N of the EIS). Of particular interest were those scientific and social studies carried out in the past few years that directly relate to either Yucca Mountain or to DOE actions such as the transportation of foreign research reactor spent nuclear fuel. DOE reevaluated the conclusions of previous literature reviews such as those conducted by the Nuclear Waste Technical Review Board and the State of Nevada, among others. DOE has concluded that:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be predicted with any degree of certainty

- Much of the uncertainty is irreducible, and

- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as accidents, which would not be expected to occur. As a consequence, DOE addressed but did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Final EIS.

8.10.2 (10747)
Comment - EIS002101 / 0009
I just read the summary, but first responders? This place should be filled with ambulance and policemen. When I talk to them about it, because I drive that nuclear waste cask around in my time when I can, I talk to first responders a lot, and they say they're trained. If they hear there's a nuclear accident, they turn their lights on, head home, get their family and go. Because that's the only response.

Response
It is the intent of Section 180(c) of the NWPA that first responders would be sufficiently trained to respond safely to an incident involving the shipment of spent nuclear fuel and high-level radioactive waste. In the event that local capabilities are not considered adequate for the task, the state, tribe, or local government may request assistance from Federal agencies under the Federal Radiological Emergency Response Plan. Additional information on emergency response and Section 180(c) is available in Section M.6 of the EIS.

8.10.2 (10997)
Comment - EIS001952 / 0012
DOE is relying upon local community assistance for fire, EMT [emeergency medical technician], and police assistance, should [the] need arise. DOE must consider local interpretation of democracy. Charges against the Village of Sardinia's police chief were subject of special village council meeting. Council member who expressed concern that background checks may be less than adequate was told that she didn't ask to see the personnel file before employment. She didn't verify what she was told and she didn't ask the right questions, apparently. In response to members of council who felt village residents and council were entitled to answers:

The mayor told members who were questioning actions that he could air dirty laundry of people at this table. When asked by a councilman whether investigation would be appropriate response to residents concerns, the mayor responded by saying:

...if residents weren't happy they would have attended the meeting. (Attachment VII... THE BROWN COUNTY PRESS, "Sardinia Council Alleges Mayor Withholding Data, 2/27/00, pg. 1.)

Note that council met in special session!! Previous council meeting adjoined out of the public view to discuss matters of personnel.

Response
The commenter is correct in stating that DOE assumes that local, state, or tribal public safety officials would most likely be the first to respond to an accident involving radioactive materials. Section 180(c) of the NWPA requires

DOE to provide funds and technical assistance for emergency response training to states and tribes that would have shipments move through their jurisdictions.

DOE recognizes that emergency preparedness capabilities and needs vary from jurisdiction to jurisdiction. To assist states and tribes to determine what their needs are and where the 180(c) funds and assistance can best be applied, DOE will provide a one-time planning grant to aid in making this determination. Additional discussion of Section 180(c) can be found in Section M.6 of the EIS.

The remainder of the comment is outside the scope of this EIS.

8.10.2 (11365)
Comment - EIS002278 / 0002
I would also like to talk a little about my concerns about the fact that the Department of Energy and their predecessors have a track record that is abysmal.

We know that every place that they have dealt with nuclear energy, they have leaks and contaminations. We know Hanford now is leaking into the Columbia River, and it's becoming the most nuclear polluted river in the world. And yet here we have an aquifer that they are willing to perch massive amounts of plutonium above and seem to have no problem with: Well, oops, we made another mistake.

They say, you know, it will be dry waste they will be transporting; but they said that about the wastes that they transported from Fernald that was found leaking in a truck stop that came in outside of Kingman, Arizona.

Response
Spent nuclear fuel and high-level radioactive waste would be dangerous sources of radiation if they were not safely contained and shielded and, as with other hazardous materials, directly exposing people would lead to health, and possibly life-threatening, consequences. For these reasons, the regulations of the Nuclear Regulatory Commission and the U.S. Department of Transportation, as well as DOE's own internal orders, specify containment, shielding, thermal, and nuclear safety requirements for shipping containers (casks). These regulations are designed to preclude even a remote chance of direct exposure. Nonetheless, spent nuclear fuel and high-level radioactive waste are not easily dispersed; they do not dissolve in water; they are not liquids or gasses that can be easily spilled or leaked, and, with the exception of a very small, nearly undetectable effect, radiation from them does not make other materials radioactive. Spent nuclear fuel and high-level radioactive waste are solids. They are hard, tough, and dense ceramics, metals, or glasses contained within tough metal barriers.

The incident to which the commenter refers occurred in December 1997 and involved the shipment of low-level radioactive waste from the Fernald Site in Ohio to the Nevada Test Site. The driver of the truck noticed en route that the liquid was leaking from the container and followed the proper steps to notify local authorities and DOE of the leak. Subsequent investigation revealed that the liquid was not contaminated and that, while there are some steps that should be taken to prevent such an incident from occurring again, there was no harm to workers or the environment.

8.10.2 (11409)
Comment - EIS002251 / 0007
They have said that today, it would be 2010 before they begin shipments. In St. Louis, they said, quote, 2004 possibly. They said today that they would have four years of training before shipment. And so to me, that doesn't jibe if they are saying that it could start in 2004, and I know for a fact that there's been evidence in this room and Las Vegas that there's no training going on.

Response
Section 2.1.2 of the EIS discusses the schedule for the repository and other facilities and operations. The current schedule calls for shipments to begin in 2010. For a 2010 start of shipments, training of emergency response personnel would begin no later than 2006.

8.10.2 (11572)
Comment - EIS002281 / 0002
I do know toxic waste goes through Shoshone, and I was told just a few months ago a truck was stopped in Shoshone that was leaking, and I don't know how many hours before they finally got it cleaned up because Shoshone is so far – it's 60 miles from Baker and Baker isn't much to talk about. 60 miles from Death Valley, which has no services that could help for that.

Response
The spent nuclear fuel and high-level radioactive waste would be transported to the proposed repository in shipping casks which would be designed, manufactured, and operated under the regulations of the Nuclear Regulatory Commission. Of the thousands of shipments completed over the last 30 years, none has resulted in an identifiable injury through release of radioactive material. Additional information concerning cask safety can be found in Section M.4.1 of the EIS. The materials destined for the proposed repository would be in solid form, so there is no possibility of a leak.

DOE is required by Section 180(c) of the NWPA to provide technical assistance and funding to states for the training of public safety officials of appropriate units of local governments and tribes through whose jurisdictions these shipments would be made. Under this program, a one-time planning grant would be provided to determine the needs of these jurisdictions for safe routine transportation and emergency response. It would be appropriate in this assessment to determine how to handle incidents in remote areas.

8.10.2 (11582)
Comment - EIS002235 / 0005
What is the contingency plan? How will the responsive team be mobilized? Where are the workers to come from? To where will the victims be transported and how will they be housed during these days? How will 42 square miles and everything in it be decontaminated? In my brief 20 years cleaning up hazardous waste sites, I would expect decades, not 460 days.

Response
Local, state, and tribal governments are responsible for responding to accidents, including those involving radioactive materials, in their jurisdictions. The Federal Government and, in particular, DOE have radiological response resources available to assist when requested.

As required by Section 180(c) of the NWPA, DOE will provide financial and technical assistance to states and tribes for training local public safety officials in the areas of emergency response and safe routine transportation. DOE expects to provide this assistance beginning at least 4 years before shipments commence to a repository through a particular jurisdiction. Additional information on Section 180(c) is provided in Section M.6 of the EIS.

Although DOE and its contractors would develop their own emergency response plans, the preparation and implementation of emergency response, evacuation and contingency plans is a state or tribal responsibility for their jurisdictions. Section 180(c) funding will be provided to eligible jurisdictions for the preparation of these plans as well as emergency response and safe routine transportation planning and coordination activities.

In the unlikely event someone was contaminated as the result of an accident involving shipments to a repository, there are several means to deal with this. Major hospitals are equipped to deal with radioactive contamination because they routinely handle medical radioisotopes. In cases where there is no training or procedures to handle a contaminated individual, assistance can be obtained from the DOE Radiation Emergency Assistance Center/Training Site (REAC/TS). REAC/TS is on call 24 hours a day to provide direct or consultative help with cases where people have been involved in a radiation accident. Federal Government assistance is regionally based and can be mobilized and on the scene in a few hours, although it might take as long as 48 hours to be fully functional. A discussion of accident cleanup is in Section J.1.4.2.5 of the EIS. Additional information on emergency response can be found in Section M.5.2.

8.10.2 (11605)
Comment - EIS002237 / 0003
What happens if there is an accident? That's what everybody has talked about today. Nye County fears that the high level will follow the same avenue as low level is today.

You have got to realize that in my district where I live, I can leave home before daylight, drive all day, never pass through a town, get home after dark and never get out of the county. That's how big it is. And there's absolutely no radio communication out there, no medical facilities. We have to rely on our volunteers.

Just recently the Federal government funded the State of Nevada for safety and training, but what about Nye County? Is this how you thank Nye County for wanting to work with you?

Response
As required by Section 180(c) of the NWPA, DOE will provide financial and technical assistance to states for training public safety officials of appropriate units of local government and tribes in the areas of emergency response and safe routine transportation. DOE expects to provide this assistance beginning at least 4 years before shipments to the proposed repository commence in a jurisdiction. The proposed policy and procedures that address the implementation of Section 180(c) state it is DOE policy that each responsible jurisdiction would have the training necessary for safe routine transportation of spent nuclear fuel and high-level radioactive waste and to respond to incidents or accidents involving these shipments. DOE will provide the funds and technical assistance to obtain this training. Additional discussion of Section 180(c) can be found in Section M.6 of the EIS.

8.10.2 (12083)
Comment - EIS002310 / 0002
[The Oak Ridge Reservation Local Oversight Committee] strongly urges that the federal government provide sufficient funds to Nye County and other Nevada counties impacted by waste transport to Yucca Mountain for the purpose of ensuring adequate local capabilities for emergency preparedness, communications, and response.

Response
In response to comments, additional information has been provided in Section M.3.2.2 of the EIS on the proposed operational aspects of spent nuclear fuel and high-level radioactive waste transportation, emergency response planning, and financial assistance programs. Section 180(c) of the NWPA requires DOE to provide technical and financial assistance to states and tribes to train public safety officials in emergency response and safe routine transportation. As a result of this program first responders would likely have sufficient training to be knowledgeable of the hazards to which they could be exposed from spent nuclear fuel and high-level radioactive waste shipments. Part of the Section 180(c) funds are for planning and coordination activities. States and tribes may use a percentage of the funding to purchase equipment for training purposes, which may then be used for emergency response, if necessary. States and tribes may request additional support from various Federal agencies in the event of an incident.

8.10.2 (12250)
Comment - EIS000995 / 0016
What is the ratio of emergency personnel who are trained to respond to high-level radioactive waste transport accidents to the general population in any give area, or say, in Oakland, Missouri, where my family lives?

Response
Section M.6 of the EIS identifies the need for providing technical assistance and training for emergency response related to transportation of spent nuclear fuel and high-level radioactive waste. DOE did not determine the ratio of emergency responders to the general population in the EIS. Once a repository site was approved, DOE would implement Section 180(c) of the NWPA. Under this provision, DOE would provide technical assistance and funds to states to determine the need for and training of public safety officials of appropriate units of local government and tribes through whose jurisdictions shipment would be made to the repository. It is up to the eligible state and tribe, in consultation with local governments and first responders along the routes, to select who gets this funding and technical assistance. A one-time planning grant would be provided to every eligible state and tribe to determine the needs for this funding. In their applications for Section 180(c) funds, DOE expects states and tribes to consider the needs of, and show how training would be provided to, local jurisdictions and their appropriate public safety

officials. Additional information concerning implementation of Section 180(c) can be found in Section M.6 of the EIS.

8.10.2 (12251)
Comment - EIS000775 / 0002
First responders in such states should be notified and be on alert for potential exposure to radioactive material in case of an accident. 'First responders' should be added to the list of maximally exposed individuals on page J-43, Section J.1.3.2.2, with appropriate calculation of potential exposures (person-rem, dose-risk) added to appropriate tables throughout Chapter 6, Environmental Impacts of Transportation.

Section J.1.2.2, page J-23 states that the Office of Civilian Radioactive Waste Management plans to identify the preliminary routes for shipments of waste and notify governors and tribal leaders. It may be appropriate for the OCRWM to take responsibility to notify appropriate authorities regarding 'first responder' safety.

Response
One purpose of the DOE proposed policy and procedures (see Sections 6.2.4.2 and M.6 of the EIS) for implementing Section 180(c) of the NWPA is to describe the steps DOE plans to take to provide technical assistance and funding to states and tribes in the area of training, including training for emergency preparedness, for safe routine transportation and emergency response for shipments of spent nuclear fuel and high-level radioactive waste. DOE expects first responder safety would be fully addressed during training supported by DOE funds and technical assistance required under the provisions of Section 180(c).

At least 4 years prior to the first shipment of spent nuclear fuel and high-level radioactive waste from generator sites to Yucca Mountain through a state or tribal jurisdiction, DOE plans to notify the associated governors and tribal leaders. This notification would be the basis for states to submit applications to DOE for grants for determining training needs, and funding and technical assistance under Section 180(c).

Federal- and state-supported training for responding to accidents involving hazardous materials, including radioactive materials, as well as training that would be supported by DOE for shipments of spent nuclear fuel and high-level radioactive waste, makes it unlikely that a first responder would receive a dose as high as that estimated in the EIS for a maximally exposed individual. The estimated doses from accidents to maximally exposed individuals presented in Section 6.2.4.2 of the EIS are high estimates for maximum reasonably foreseeable accidents that could occur, which would have a likelihood of occurring between once in 1 million years and once in 10 million years. These doses are estimated with the assumption that a maximally exposed individual was present for the full duration of an accident at the location where exposure to radioactive materials in the air and on the ground would lead to the maximum dose that could occur. The doses for a legal-weight truck accident and for a rail accident show 0.75 rem and 29 rem, respectively, for the maximally exposed individuals. In addition, DOE has included estimates of the dose to an emergency responder to a severe accident. The largest estimated dose for a first responder is 0.83 rem. This dose is estimated for a first responder to a severe rail accident where a portion of the cask's lead shield had been displaced. This dose would lead to an estimated increase in the risk of a latent fatal cancer of about 3.3 in 10,000 over the individual's lifetime.

8.10.2 (12263)
Comment - EIS002175 / 0008
Many hospitals do not have isolation rooms for radioactively contaminated victims. This analysis should at least be done for the major population centers along the transportation routes (populations of 100,000 or more). The DEIS should indicate what emergency response equipment, facilities, and trained personnel are available in these communities, and what the effects of a transportation accident could be based on what is currently available.

Response
The analysis of the impacts of transportation accidents in the EIS did not take credit for the mitigating effects of emergency response activities. Therefore, no attempt was made to determine emergency response capabilities along the routes analyzed. In the unlikely event someone was contaminated as the result of an accident involving shipments to a repository, there are several means to deal with this. Major hospitals are equipped to deal with radioactive contamination because they routinely handle medical radioisotopes. In cases where there is no training or procedures to handle a contaminated individual, assistance can be obtained from the DOE Radiation Emergency

Assistance Center/Training Site (REAC/TS). REAC/TS is on call 24 hours a day to provide direct or consultative help with cases where people have been involved in a radiation accident.

Section 180(c) of the NWPA requires DOE to provide technical assistance and funds for emergency response training to states and tribes that would have shipments move through their jurisdictions on the way to a repository. Under the current plan, a one-time planning grant will be provided to eligible states and tribes to assess the need for this technical assistance and funds. Additional discussion of Section 180(c) can be found in Section M.6 of the EIS.

8.10.2 (12604)
Comment - EIS001775 / 0004
Another person asked where was the EPA [Environmental Protection Agency]; not necessary for an environmental impact statement. Have you calculated the cost of training HAZMAT [hazardous material] teams all along the travel route? Is it even possible for local HAZMAT teams to cope with a nuclear incident should a train derail or a truck overturn? How many HAZMAT teams would there have to be, spaced how far apart? Are the utility companies going to pay for that, are local governments, are the U.S. Taxpayers? Can local hospitals even cope with such a nuclear accident?

The federal government does not have a flawless record on projects involving technology and you know about the Mars probe, the Y2 glitch and the spy satellite, MTVE and the EPA and then we see the failure of a new advanced anti-missile system. A miscalculation or a glitch or an accident would not only be another failure in technology, it could mean disaster for an entire community, an entire region of the country such as the midwest, indeed the whole nation itself.

Response
Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel or high-level radioactive waste. The costs of providing this technical assistance and training have not yet been determined but the funds would come from the Nuclear Waste Fund and would be authorized by the Congress. According to the Notice of Revised Proposed Policy and Procedures published in the *Federal Register* (63 *FR* 23753-23766, April 30, 1998), a one-time planning grant of $150,000 would be provided to eligible states and tribal jurisdictions for the determination of training and funding needs and for preparation of the application for funds about 5 years before shipments.

State and local governments deal with transportation accidents involving hazardous materials on a daily basis across the U.S. According to the Notice of Revised Proposed Policy and Procedures, DOE would provide funding and technical assistance to eligible jurisdictions along transportation routes to address incremental training requirements resulting from shipments of spent nuclear fuel and high-level radioactive waste to the repository. DOE would allow a variety of activities an applicant state or tribal jurisdiction might consider appropriate for training under the Section 180(c) program. Along a specific transportation route, it would be the applicant's decision as to who received training.

The DOE Radiation Emergency Assistance Center/Training Site (REAC/TS) has been working with state and local groups, including hospitals, to provide medical emergency response training, as well as providing treatment and medical consultation for injuries resulting from radiation exposure and contamination. Among the training courses offered are courses in the handling of radiation accidents by emergency staff, and medical planning and care in radiation accidents.

8.10.3 LIABILITY

8.10.3 (182)
Comment - 12 comments summarized
Commenters expressed concern regarding liability for transportation accidents involving spent nuclear fuel or high-level radioactive waste. Issues raised included who would be liable, who would pay the cost of cleaning up, and how would people be compensated for damages suffered as a result of a transportation accident. Commenters noted that insurance policies routinely exclude nuclear and radioactive accidents from policy coverage and wondered if taxpayers would be levied an additional tax burden for increased indigent medical funds. Commenters brought up

the financial burden that could be imposed on state or local governments as a result of a transportation accident. One commenter sought a total buyout of property damaged in a nuclear accident. Some commenters sought additional information regarding who would be responsible for cleanup.

Response
With respect to damages associated with an accident involving spent nuclear fuel and high-level radioactive waste, the Price-Anderson Act (see Section M.8 of the EIS) establishes a system of financial protection for persons who might be liable for, and for persons who might be injured by, a nuclear accident or incident. The Act provides liability coverage to DOE activities (including transportation) involving spent nuclear fuel and high-level radioactive waste. Specifically, the Price-Anderson Act establishes a system of private insurance and Federal indemnification that generally ensures that up to $9.43 billion is available to compensate for damages suffered by the public, regardless of who causes the damages. Persons indemnified include contractors, subcontractors, suppliers, state, local, and tribal governments, and any workers or persons who might be sued for damages. This indemnification would include operators of a spent nuclear fuel and high-level radioactive waste repository at Yucca Mountain and to transporters from commercial nuclear utilities and DOE sites to the repository. Congress will consider action on compensation plans to pay victims for damages that might exceed the $9.43 billion amount.

An accident that does not involve the release of radioactive materials or an authorized precautionary evacuation would not be covered by the Price-Anderson Act. Instead, it would be subject to normal state tort law applicable to any type of accident. Carriers may have private insurance to cover liability from a non-nuclear incident and for environmental restoration for such non-nuclear accidents. All motor vehicles carrying spent nuclear fuel or high-level radioactive waste are required by the Motor Carrier Act and implementing regulations (49 CFR Part 387), to maintain financial responsibility of at least $5 million. Federal law does not require rail, barge, or air carriers of radioactive materials to maintain liability coverage, although these carriers often voluntarily carry such insurance. Private insurance policies often have a nuclear exclusion to exclude coverage of nuclear accidents to reflect that those accidents involving the release of radioactive materials are covered under Price-Anderson Act indemnification. Thus, private insurance policies apply only to the extent that the Price-Anderson Act is not applicable.

Under the Price-Anderson Act, DOE does not require its contractors to carry private liability insurance as financial protection for nuclear incidents. Rather, DOE provides full indemnification to its contractors and all other persons indemnified to pay damages and provide compensation for nuclear incidents arising in connection with DOE contractual activity. To the extent Price-Anderson indemnification applies, there is no need or requirement to invoke existing private insurance policies.

DOE and the carrier would work with the appropriate government agencies to address who shall perform and who shall pay for cleanup activity where there was no release of radioactive material. In the case of a release of radioactive materials, payment for liability for the costs of the cleanup would be made under the Price-Anderson Act.

8.10.3 (7724)
Comment - EIS002018 / 0001
I am concerned about the side effects of a nuclear spill. Our health insurance will not cover us if we are exposed to the easterners waste. This isn't fair, because Nevada doesn't even produce nuclear waste.

Response
In Section 6.2.4 of the EIS, DOE recognizes the potential for transportation accidents and analyzed impacts resulting from transportation accidents. Although, given the number of shipments, traffic accidents are expected to occur, DOE does not believe that any accident would result in the release of radioactive material, primarily because of the structural integrity of the casks in which the material would be transported. In the more than 2,700 shipments involving spent nuclear fuel over the past 3 decades, there have been seven accidents, with no release of radioactive materials to the environment.

In the event of a nuclear accident or incident, the Price-Anderson Act establishes a system of private insurance and Federal indemnification that generally ensures that up to $9.43 billion is available to compensate for damages suffered by the public, regardless of who causes the damages. Damages that occur as a result of a nuclear accident or

incident at the Yucca Mountain site or during the transportation campaign would be subject to the Price-Anderson Act indemnification. Additional information on liability for nuclear incidents is provided in Section M.8 of the EIS.

8.10.3 (9468)
Comment - EIS001888 / 0139
DEIS Statement (pg. 2.51) 2.1.3.3.3.1 - To enable intermodal transfers and heavy-haul shipments to the repository, an intermodal transfer station would be built and operated in Nevada.

Clark County Comment - The DEIS is silent as to who is responsible for protecting shipments during the intermodal transfer. Further, the DEIS states that "it could build and operate an intermodal station." Is DOE committed to constructing and operating the intermodal transfer station, or is DOE going to contract this to the private sector? If so, who will have the liability from an incident at the intermodal station? Since most accidents with spent fuel occur with the transfer of waste, it is very important to know who will be responsible for this task; how it will be managed; and what role if any will be expected of local governments. Further, will local governments have the right to access such a facility to ensure compliance with regulatory standards?

NEPA [National Environmental Policy Act] Regulation: Sec. 1502. 1 Purpose; Sec. 1502.14 A Alternatives including the proposed action; Sec. 1502.16 Environmental consequences.

Response
As discussed in Chapter 2 of the EIS, DOE would be responsible for shipments of spent nuclear fuel and high-level radioactive waste during the entire shipping campaign, regardless of whether private contractors were actually conducting the shipments or operating the associated facilities. In addition, the Department and its contractors would comply with all applicable regulations of the U.S. Department of Transportation and the Nuclear Regulatory Commission. Under these regulations, states and tribes could have authority to inspect shipments of spent nuclear fuel and high-level radioactive waste originating in or passing through their jurisdictions. Access to, or inspection of, facilities for enforcing compliance with Federal regulations would likely remain the responsibility of Federal agencies.

As discussed in Section 6.3 of the EIS, the shipping casks would remain sealed at all times during intermodal transfer facility operation. The forces to which the casks could be subjected during handling accidents at the facility would be significantly less than those required to cause a breach. Therefore, the radiological risks to the public from accidents at the intermodal facility would be very low.

The Price-Anderson Act establishes a system of private insurance and Federal indemnification that generally ensures that as much as $9.43 billion is available to compensate for damages suffered by the public in a nuclear accident or incident, regardless of who causes the damages. Damages that occurred as a result of a nuclear accident or incident at the Yucca Mountain site or during the transportation campaign, including at an intermodal transfer facility, would be subject to Price-Anderson Act indemnification. The liability of all responsible parties is limited to the amount of coverage provided by the Price-Anderson system. State and local governments cannot be required to provide additional compensation. Additional information on nuclear incident liability is provided in Section M.8 of the EIS.

As described in DOE's current planning for transportation operations, physical protection of shipments would be the responsibility of the Regional Servicing Contractors and transporters as described in Sections M.2 and M.7 of the EIS. Physical protection of shipments would comply with requirements of the U.S. Nuclear Regulatory Commission presented in 10 CFR Part 73.

8.10.3 (12543)
Comment - EIS001282 / 0002
The Draft Environmental Impact Statement acknowledges that it is not a question of whether an accident will happen while these high-level radioactive waste materials are being transported across our country. Section 6.2.4, "Accident Scenarios," explains that a certain number of accidents are "reasonably foreseeable." The questions are where and when the accidents will occur.

Will the emergency responders; the police, fire, and hospitals, be prepared? All responders, hospital personnel and anyone else coming in contact with this nuclear waste have the right to know how to respond when accidents take

place! Who will provide support when accidents occur, a representative in Washington or somewhere else in the country? This is unacceptable! Who will be liable for the damages and expense resulting from these accidents?

Our highways and rail corridors are designed to connect population centers and to bring goods to market, not to transport high-level radioactive waste. Transporting this dangerous material via highway and rail pulls the City of Cleveland and the citizens of the City of Cleveland directly into harm's way. It will take a full-scale effort, well in advance of any transportation of radioactive material, to provide protection against the inevitable accidents. The cost of fully training and equipping the emergency responders, in all the cities along the transportation routes, to handle an accident involving high-level radioactive waste must be factored into the cost equation for the Yucca Mountain Project. The cost of the necessary preparation for accidents and liability for damages must be assigned to someone other than the local governments of cities standing, unfortunately, between the nuclear waste producers and the final disposal site.

Response
As required by Section 180(c) of NWPA, DOE would provide technical assistance and funds to states and for training public safety officials of appropriate units of local governments and Native American tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. Training would cover procedures required for safe routine transportation of these materials, as well as for dealing with emergency response situations. DOE would institute its program to implement the requirements of Section 180(c) before beginning shipments to the repository. In the event of an incident involving spent nuclear fuel or high-level radioactive waste, the vehicle crew would notify local authorities and the central communications station monitoring the shipment. DOE would make resources available to local authorities as appropriate to mitigate such an incident. Sections M.3.2.2, M.5, and M.6 of the EIS contain more information on emergency response capabilities and the provisions and implementation of Section 180(c), respectively.

In the event of a nuclear accident or incident, the Price-Anderson Act establishes a system of private insurance and Federal indemnification that generally ensures that as much as $9.43 billion is available to compensate for damages suffered by the public, regardless of who causes the damages. Damages that occurred as a result of a nuclear accident or incident at the Yucca Mountain site or during the transportation campaign would be subject to the Price-Anderson indemnification. Section M.8 of the EIS contains more information on liability for nuclear incidents.

8.11 Transportation - Affected Environment and Impacts

8.11.1 LAND USE

8.11.1 (134)
Comment - 11 comments summarized
Commenters expressed concern that the Draft EIS did not adequately examine the impacts to land use from the construction of a rail line in Nevada. Specific concerns include impacts to recreation (camping, hiking, fishing, hunting, nature study, back Country travel, sightseeing, and Wilderness Areas); continued access to recreation areas due to blocked roads; mining and mineral resource potential (especially through parts of north Central Nevada where active mining is occurring and where the mineral potential is high); timber lands; and private property (including ranches and patented mining land). Some wanted to know if private property would be condemned along and near the rail line, and if so, would the property owners be given fair market value for their land.

Some commenters said that any rail line in Nevada would conflict with existing land-use plans developed by the Bureau of Land Management. The EIS will remain insufficient until a complete inventory of land use and land management impacts are addressed, particularly in consultation with affected Federal and State of Nevada land management agencies.

Others said that construction of a branch rail line would be much more destructive than the use of trucks on existing roads, especially considering that the rail line would be used only for several decades.